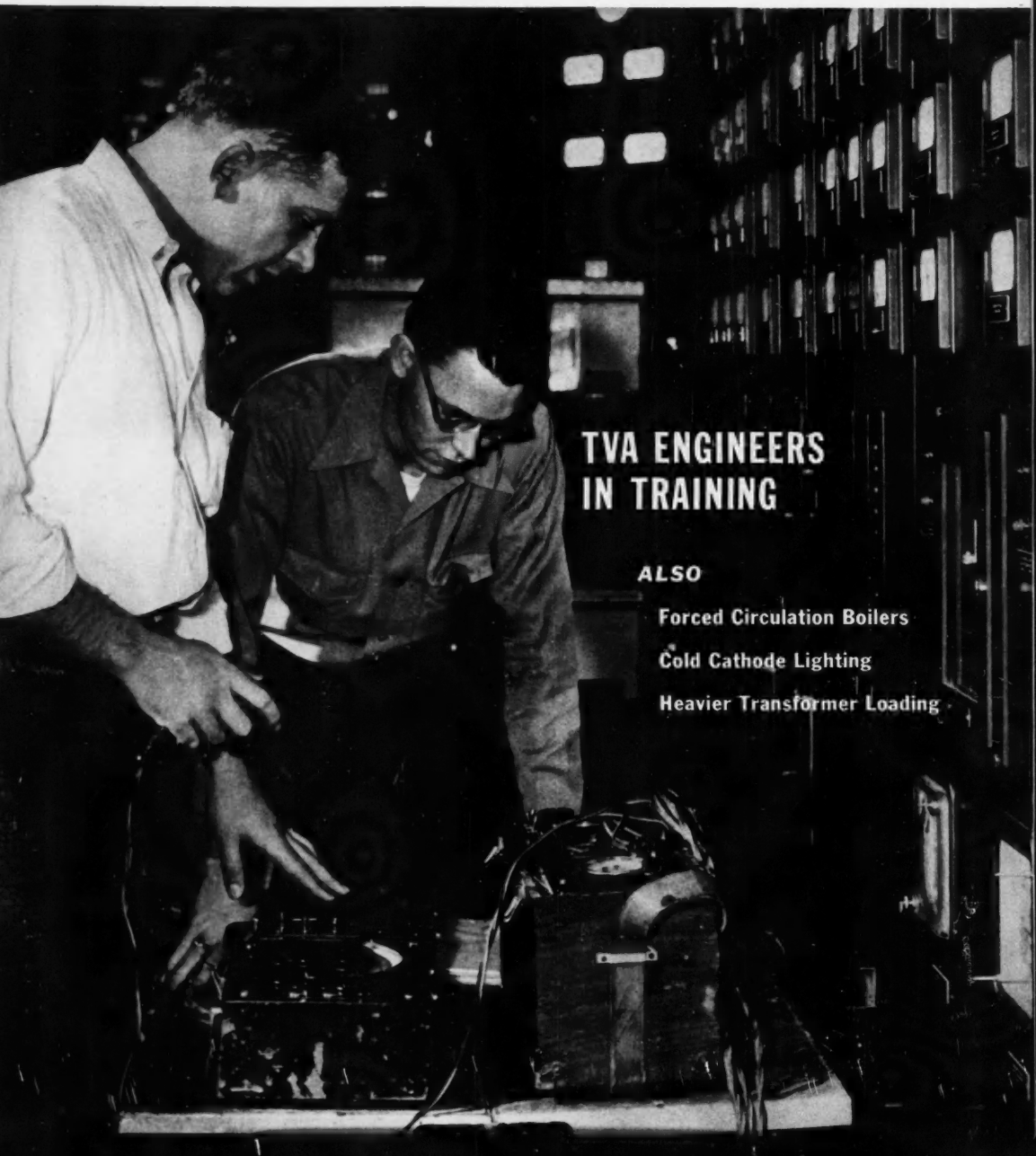
OCTOBER 22, 1951

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION



TVA ENGINEERS IN TRAINING

ALSO

Forced Circulation Boilers

Cold Cathode Lighting

Heavier Transformer Loading

55 AMPERE CIRCUIT BREAKER SERVICE CONTROL

...ALWAYS CARRIES FULL LOAD

Another NEW Murray Product

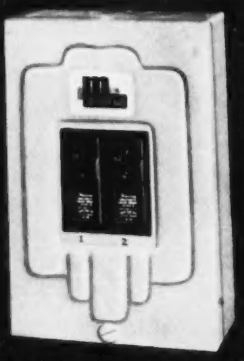
that gives you

Fully Magnetic

circuit protection

Fully Magnetic Circuit Breakers always carry their full rated load—never need derating. The magnetic principle of operation is not affected by changes in temperature.
Murray Breakers give three way circuit protection.

1. Timed delay to carry harmless overloads.
2. Timed tripping on dangerous overloads.
3. Immediate tripping on short circuits.



MANY ADVANTAGES

1. Fully Magnetic Circuit Protection.
2. Solderless connectors, and ample wiring room make it EASY TO INSTALL.
3. Seven concentric KO's—where you need them.
4. Easy to gang (no side handles).
5. Compact 7⅜"x 4⅞"x 3-11 16" (Surface type).
6. Also available in flush.

WHAT IS IT?

Service Control equipment with 55 ampere main capacity and two—50 ampere single pole Fully Magnetic Circuit Breakers. Supplied with handle extension for simultaneous manual tripping. Available in surface or flush. Listed by Underwriters' Laboratories, Inc.

HOW IS IT USED?

1. **In place of a comparable 60 ampere fused switch.**
2. **As service entrance equipment.**
3. **As a main disconnect.**
4. **For protecting single phase lighting and appliance circuits or for fractional horse power motor circuits.**
5. **For protecting electric range circuits.**
6. **For use on 2 wire, 250 volt service without neutral or; 3 wire 125-250 volt wiring with neutral or 2 wire 125 volt with neutral.**

IS IT AVAILABLE?

YES—immediate shipment—see your electrical distributor or write the factory—specify catalog number LC002H.

One Of The Family

Another addition to Murray's growing Circuit Breaker equipment line. Others include —The 2 circuit 40 amp and 100 amp, the "6", the "8", the "12" and the "20" Circuit Protectors. Panel boards up to 42 branch circuits.

50 YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

For detailed information, write:

MURRAY MANUFACTURING CORPORATION
1250 ATLANTIC AVENUE · BROOKLYN 16, N.Y.

Service Entrance & Meter Equipment · Magnetic Circuit Breakers · Switches · Current Limiting Reactors · Crows' Nest Aerial Ladders

STORM WARNING?

Remember last year's big blow, the one that laid low so many lines and spread so many headaches?

It happened on last November 25 and in the Nov. 5 issue, approximately a year later, Electrical World presents a carefully-compiled review of the storm, the damage it did, and the lessons it taught us. Forewarned is fore-armed—and if she blows up again we'll be a lot better prepared.

Nineteen utility companies told us their storm experiences, and the weather bureau gave us their long report on the storm's origination, path of destruction, and final retreat.

From all of this we have set down complete details on 13 separate and major operating lessons learned through the bitter experience of straightening out after a severe storm.

TRADE MARKS

A few months back, Electrical World received a thick sheaf of manuscript from H. G. Burd of Ansonia Electric Co. Mr. Burd had begun a compilation of the trade names and trade marks of wire and cable and insulation used in electric power.

Using Burd's list as a nucleus we decided to carry the inquiry further, so we sent a copy of Burd's list to all the manufacturers we could find, asking them to check. We then alphabetized the names, and sent mimeo copies to the manufacturers again.

The final result is in the forthcoming (Nov. 5) issue—a compilation of 461 trade names and trade marks of wire and cable and insulation material . . . useful, we believe, to the manufacturers themselves, simply because nobody has ever before made a careful check on who makes what.

Electrical World

Published for 77 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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CONSIDER THESE 8 EXTRA VALUES OF OKONITE-CALLENDER PAPER INSULATED CABLES

(1) CLEAN METALS THROUGHOUT—electrolytic "scrubbing" removes all foreign particles, soap and tallow lubricants from the copper conductors, metal tapes and pressure tubes.

(2) IMPROVED CONDUCTOR SHAPE — conductor-shaping machinery has been modified to eliminate plane surfaces and small radii from the conductors. This assures a snug fit of the insulating papers, reducing ionization.

(3) USE OF METALLIZED PAPER TAPE — metallized paper tapes, wrapped over conductor and insulation improve safety factor, reduce ionization, increase break-down values, and retard thermal aging of the insulation.

(4) HIGH INSULATION STABILITY — test results on Okonite-Callender insulation show substantially better values than required by A.E.I.C. specifications. In the past ten years, not a single case of defective insulation causing cable failure has been reported.

(5) LEAD STABILIZED BY SODIUM TREATMENT — sodium treatment of virgin lead removes impurities and "stabilizes" the lead so that it does not oxidize during the sheathing operation. Contributes to a structurally sound lead sheath, free from inherent defects.

(6) OKOMETAL FATIGUE-RESISTANT SHEATH — Okometal is an arsenical lead alloy, exclusively used by Okonite-Callender. In standard bending tests, Okometal outlasts copper-silver-bearing lead over 3½ to 1!

(7) UNIFORMITY OF SHEATH THICKNESS — electronic concentricity gauge permits the enforcement of a self-imposed limit of thickness uniformity variation less than *half* that of A.E.I.C. specifications.

(8) OKOSHEATH PROTECTIVE COVERING — in 17 years, no case of sheath corrosion has been reported on any cable having an Okosheath Protective Covering, the only covering that incorporates a heavy homogeneous wall of vulcanized neoprene firmly bonded by vulcanization to the lead.

When you specify Okonite-Callender paper-insulated power cables you not only get better initial value than called for in the A.E.I.C. specifications, but you also obtain built-in features that make it possible to retain these characteristics during the operating life of the cable. Ask for Bulletin EW-1052 and get the complete story. The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE SINCE 1878 ***insulated wires and cables***

THE RIGHT TOOLS–
right when they're needed

For prompt, efficient completion of any line job, make sure your linemen have the right tools — *right* when they're needed.

And, for the easiest way to obtain this equipment, make it a point to order from Graybar. On a single transaction, you can get pliers, wrenches, shovels, and all the other tools you need for line construction and maintenance . . . safety equipment for hot-line repairs . . . even line trucks and trailers.

By ordering through Graybar, you save the time and expense of multiple inquiries. You get products that are dependable and give long service-life — products that have been tested and accepted by linemen throughout the nation.

Your local Graybar Representative is a convenient source of information on all of the other materials required for utility pole-line projects. You'll find him well-informed on both availability and usage of the more than 100,000 electrical items distributed by Graybar.

Remember, too, that for special help on difficult problems, an experienced Graybar Outside Construction Specialist is at your service.

Graybar offices and warehouses are strategically located in over 100 cities — a feature that enables us to give you efficient local service on day-to-day orders and often saves valuable time in emergencies. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.*

176-910

You get the best of everything electrical
Via GraybaR

IN OVER 100

Lower Cost Energy for Northern Missouri

BETTER TRANSFORMER PERFORMANCE is one explanation why you pay lower than World War II prices for energy at a time when prices are at an all time high. Four Allis-Chalmers transformers installed at the Mexico, Missouri, station — and many Allis-Chalmers transformers on their northern network — are helping Missouri Power and Light company sell economical energy.

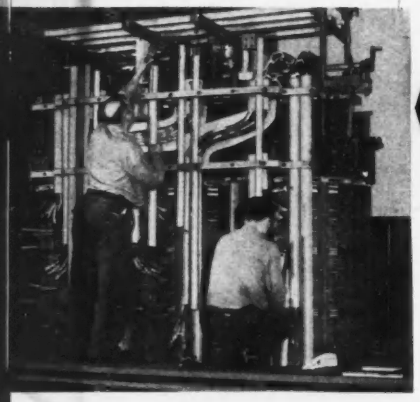
Here are a few reasons why:

Oil sealed inert gas system guards the power transformers against moisture and oxygen and inhibits sludge and acid formation. This original Allis-Chalmers designed protective system is standard on over 5,000,000 kva of American power transformers. Its low operating pressure, seldom exceeding one pound per square inch, and controlled gasket compression, boosts gasket life. There are no expensive, sensitive gages or reduction valves to maintain or to adjust periodically.

To help Missouri Power and Light company make important savings and still operate safely without large stocks of spare bushings . . . all these transformers have interchangeable bushings.

To give you more transformer performance Allis-Chalmers engineers are tackling problems of noise level in their sound laboratory. They're solving the corona problem so that your Allis-Chalmers transformers of the future will have even better surge and lightning protection.

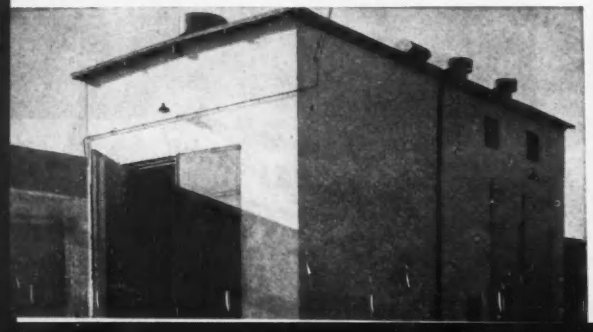
Because they're designed better you'll continue to see an ever increasing number of Allis-Chalmers transformers on the systems of the nation's power users. For information call in your A-C sales representative. Offices in 64 principal cities. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3451



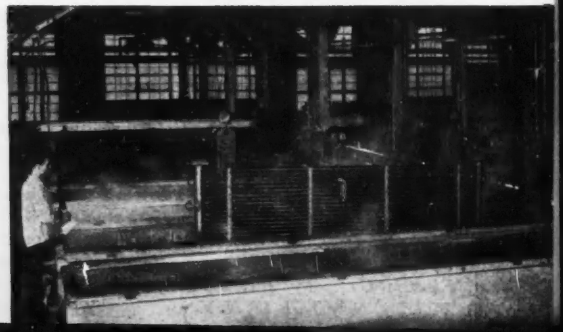
High voltage windings, coils and leads are strongly supported and securely braced as this high voltage view of core and coils shows. Leads from windings are mechanically supported and heavily insulated by encasement in machine wound tubing.

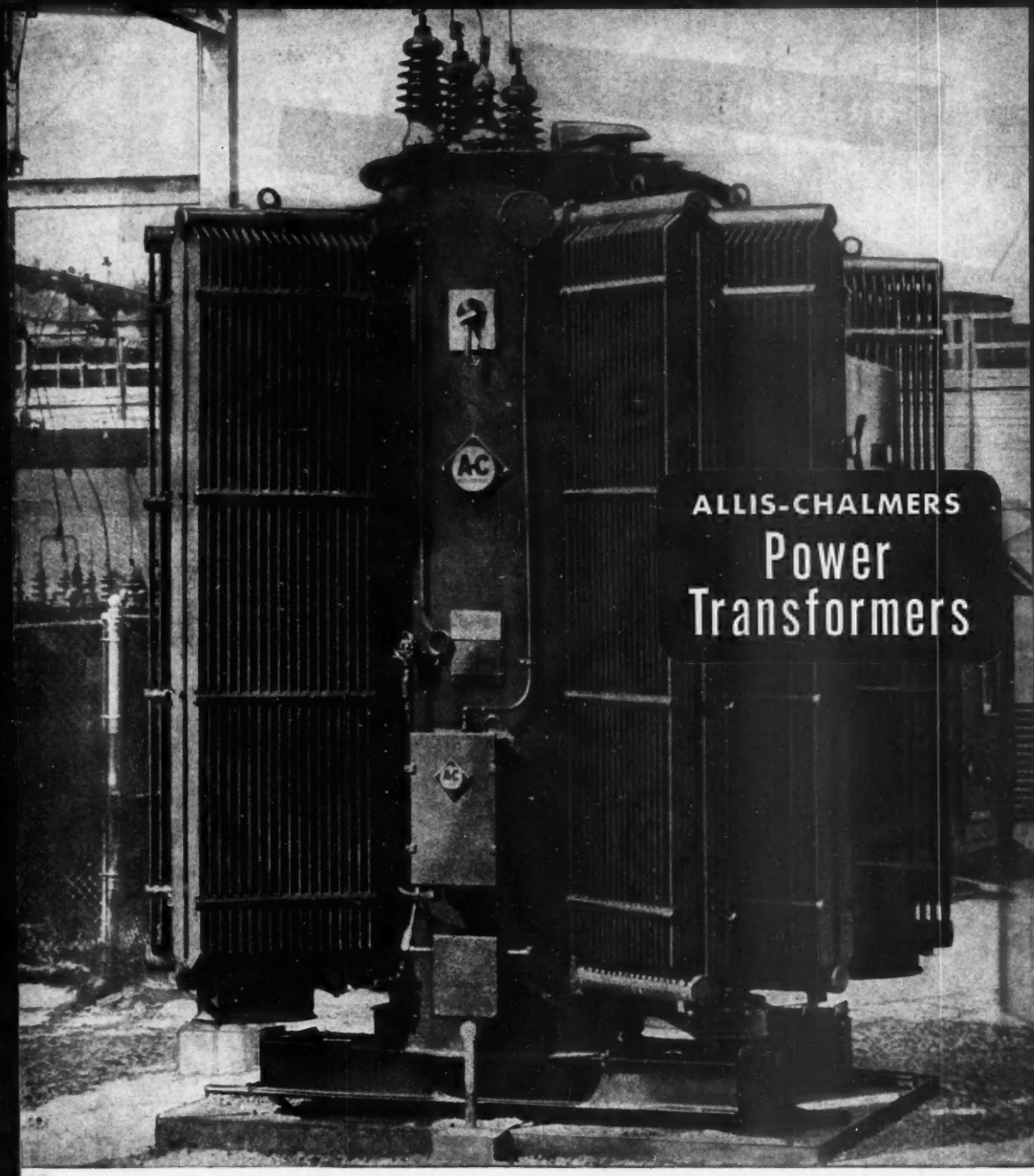
By providing closely regulated voltage for all types of loads, this easily adjusted 375 kva AFR feeder voltage regulator (rated 4160 volts) regulates the power supply for local distribution. In the background is a 3750 kva power transformer that steps the voltage down from 13.3 kv to 4.16 kv. This transformer has a 480 volt tertiary winding to supply power to the plant auxiliaries.

This sound-proof engineering laboratory is used for audio noise and temperature testing. Two-foot walls are made of concrete, concrete block and air pockets, fiber glass and acoustic tile, and exclude 99.98% of exterior noise power.



Radiators are made corrosion resistant by a 5-step *Bonderizing* process and then rotary flow painted with two coats of tough, baked-on enamel. *Bonderizing* converts the metal surface to a non-metallic phosphate coating integral with the metal.





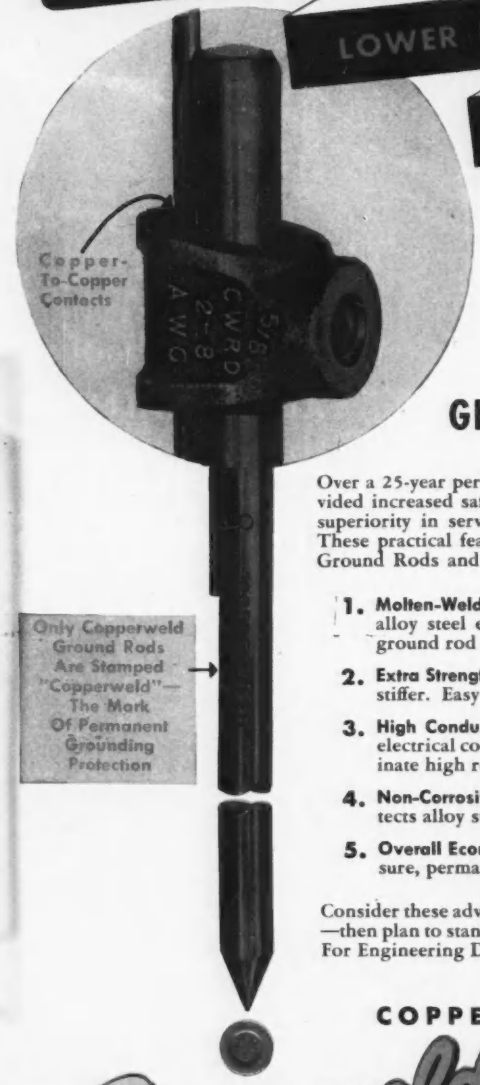
This 10,000 kva power transformer steps up voltage from 13.3 to 33 kv from generator number 2 to plant substation bus. High voltage bushings are interchangeable throughout the system where ratings permit. Provision has been made for relocation of low voltage bushings through the cover should future station design require this.

ALLIS-CHALMERS

FOR GREATER SAFETY...

LOWER RESISTANCE...

RUST-PROOF PROTECTION



Only Copperweld Ground Rods Are Stamped "Copperweld"—The Mark Of Permanent Grounding Protection

Copperweld
TRADE MARK

GROUND RODS AND CLAMPS

Over a 25-year period, Copperweld* Ground Rods and Clamps have provided increased safety for persons and equipment and have proved their superiority in service wherever driven ground electrodes are required. These practical features are sound reasons why millions of Copperweld Ground Rods and Clamps are giving permanent grounding protection:

1. **Molten-Welded**—Perfect interlocking weld between the copper and alloy steel eliminates possibility of electrolytic action. No other ground rod has this unique Molten-Welded feature.
2. **Extra Strength**—Rugged core of alloy steel is stronger—tougher—stiffer. Easy driving is assured.
3. **High Conductivity**—Thick sheath of pure copper provides high electrical conductance. Copper-to-copper contacts throughout eliminate high resistance connections.
4. **Non-Corrosive**—Rust-proof, thick copper covering permanently protects alloy steel core against corrosion.
5. **Overall Economy**—Long service life with no maintenance costs. Safe, sure, permanent grounding protection for all types of installations.

Consider these advantages in relation to your own grounding requirements—then plan to standardize on ground rods that are stamped "Copperweld." For Engineering Data, write for Bulletin E.D. 375.

MADE BY
COPPERWELD STEEL COMPANY
GLASSPORT, PA.

*Trade Mark

Copperweld TRADE MARK **GROUND RODS AND CLAMPS**

stocked and sold by { HUBBARD AND COMPANY • JOSLYN MFG. & SUPPLY CO.
And All Their Distributors

6 New Trolley Coach Lines for Boston

Metropolitan Boston likes trolley coaches. And because it does, the Metropolitan Transit Authority's fleet has grown steadily since the first installation in 1936. This year, for example, six new trolley coach routes will be established.

Popular acclaim by riders has played an important part in each MTA decision to extend trolley coach service. This popularity, as well as management's appreciation of the trolley coach's reliability and relatively low operating cost, accounts for the growth of MTA's trolley coach fleet.

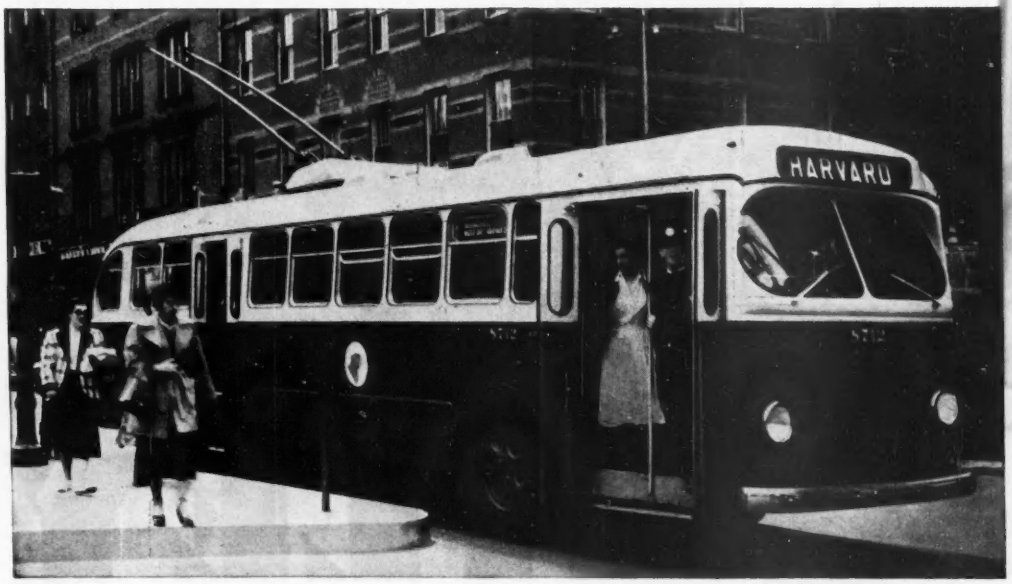
In medium-sized as well as large cities, forward-looking transit operators are using this modern electric vehicle more and more. Presently, trolley coaches are operating in 67 cities throughout the country, with populations ranging from 80,000 to upwards of 2,000,000 people. General Electric Company, Schenectady, New York.

OPERATING COSTS PER REVENUE MILE

(exclusive of depreciation)

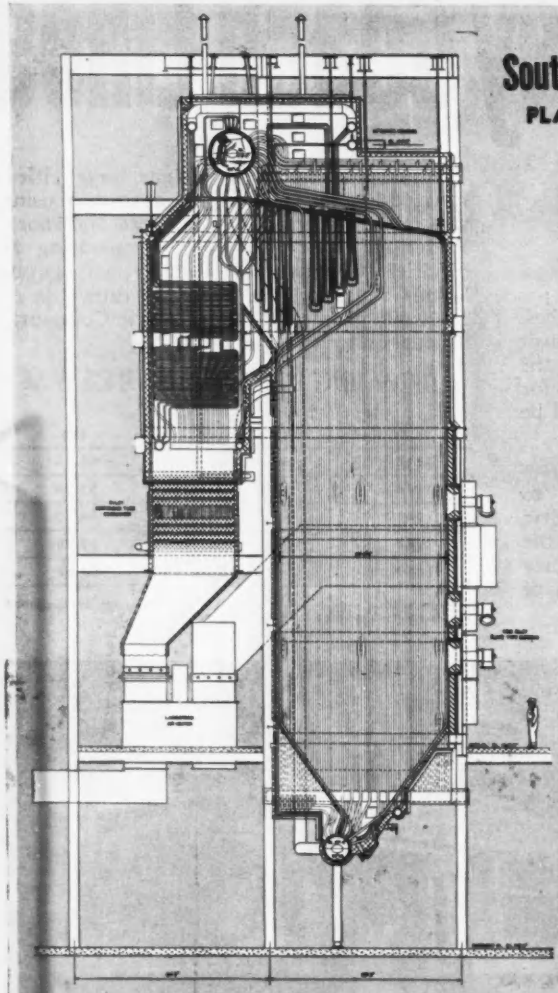
YEAR	TRACKLESS TROLLEY	BUS
1945	39.02¢	46.83¢
1946	43.03	51.00
1947	45.21	55.30
1948	54.77	61.53
1949	54.90	64.87

Average seating capacity of MTA trolley coaches is 43; self-propelled vehicles have an average seating capacity of 38.



GENERAL ELECTRIC

South Carolina Installing Their



South Carolina Electric & Gas Company
Charleston, S. C.
400,000 lbs./hr. Riley Unit

South Carolina Electric & Gas Co.

PLANT HAGOOD, CHARLESTON, S. C.

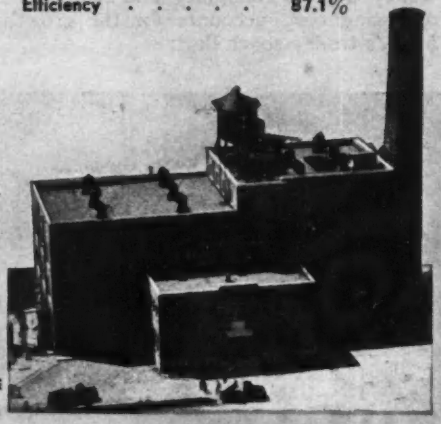
Gilbert Associates, Engineers

Capacity	400,000 lbs./hr.
Design Pressure	1475 psig
Steam Temperature	955°F.
Exit Gas Temperature	330°F.
Temperature Air	600°F.
Efficiency	87.1%

Initially Oil Fired—Future Pulverized Coal

HEAT BALANCE

Dry Gas Loss	5.06
Hydrogen and Moisture Loss	5.82
Moisture in Air Loss	0.12
Radiation Loss	0.40
Manufacturers Margin	1.50
Total Losses	12.90
Efficiency	87.1%



First Unit at Plant Hagood. Second Unit has been added. Third Unit being installed.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · St. Louis · Kansas City · St. Paul · Tulsa · Houston · Denver
Salt Lake City · Los Angeles · Portland · Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

Third Riley Unit at Plant Hagood

When South Carolina Power Company built Plant Hagood back in 1946, a 230,000 lbs./hr. 975 psig 860°F. Riley Steam Generating Unit was selected for unit No. 1. In 1948 when unit No. 2 was added, a duplicate Riley unit was ordered. Last year, another Riley unit—400,000 lbs./hr. 1475 psig 955°F. unit was ordered as unit No. 3.

After a company has operated Riley equipment, they almost invariably order additional Riley equipment when additional units are added. Public Service Company of Indiana, for instance, has ordered 7 Riley units; Iowa-Illinois Gas & Electric, 6 Riley units; Interstate Power, 7 Riley units; Houston Lighting & Power Co., 9 Riley units; Utah Power & Light, 4 Riley units; Central Ohio Light and Power, 5 Riley units.

The regularity with which Riley Steam Generating unit users repeat for additional Riley units when plants are expanded is positive proof of the excellent performance of Riley units—their reliability and continuity of service and the satisfactory service rendered by the Riley organization.

All of these public utilities have ordered Riley Steam Generating Equipment:

THE POTOMAC EDISON CO.	
Albright Station	1–700,000 lbs./hr.
IOWA ELECTRIC LIGHT & POWER CO.	
Boone Station	1–275,000 lbs./hr.
NORTHERN STATES POWER CO.	
Granite Falls Station	1–385,000 lbs./hr.
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY	
Moncks Corners Station	2–460,000 lbs./hr.
MONONGAHELA POWER COMPANY	
Albright Station	1–700,000 lbs./hr.
SUPERIOR WATER, LIGHT & POWER CO.	
Superior Station	1–125,000 lbs./hr.
HOUSTON LIGHTING & POWER CO.	
Gable Street Station	1–140,000 lbs./hr.
Gable Street Station	1–250,000 lbs./hr.
Gable Street Station	1–350,000 lbs./hr.
Greens Bayou Station	2–675,000 lbs./hr.
West Junction Station	2–400,000 lbs./hr.
West Junction Station	2–825,000 lbs./hr.
PUBLIC SERVICE CO. OF INDIANA	
Dresser Station	1–300,000 lbs./hr.
Edwardsport Station	3–400,000 lbs./hr.
Noblesville Station	3–300,000 lbs./hr.
NORTHERN VIRGINIA POWER CO.	
Riverton Station	1–350,000 lbs./hr.
CENTRAL ILLINOIS LIGHT CO.	
R. S. Wallace Station	1–600,000 lbs./hr.
R. S. Wallace Station	4–300,000 lbs./hr.
ARKANSAS POWER & LIGHT CO.	
Cecil Lynch Station	1–650,000 lbs./hr.
UTAH POWER & LIGHT CO.	
Orem Station	1–450,000 lbs./hr.
Jordan Station	1–620,000 lbs./hr.
Jordan Station	1–575,000 lbs./hr.
WORCESTER COUNTY ELECTRIC CO.	
Webster Street Station	1–325,000 lbs./hr.
WEST PENN POWER CO.	
Milesburg Station	2–210,000 lbs./hr.
INTERSTATE POWER CO.	
Dubuque Station	1–200,000 lbs./hr.
Lansing Station	2–120,000 lbs./hr.
Fox Lake Station	2–120,000 lbs./hr.
Clinton Station	1– 45,000 lbs./hr.
NEW ORLEANS PUBLIC SERVICE CO.	
Market Street Station	1–330,000 lbs./hr.
IOWA-ILLINOIS GAS & ELECTRIC CO.	
Riverside Station	3–250,000 lbs./hr.
Coralville Station	1– 60,000 lbs./hr.
Moline Station	2–200,000 lbs./hr.
CITY OF LOS ANGELES	
Harbor Steam Station	3–825,000 lbs./hr.
Harbor Steam Station	2–675,000 lbs./hr.
MISSISSIPPI POWER CO.	
Plant Eaton	3–230,000 lbs./hr.
OTTER TAIL POWER CO.	
Kidder Station	2–100,000 lbs./hr.
Crookston Station	2– 75,000 lbs./hr.
Devils Lake Station	1– 75,000 lbs./hr.
Canby Station	1– 75,000 lbs./hr.
OHIO EDISON CO.	
Mad River Station	1–250,000 lbs./hr.
SOUTH CAROLINA POWER CO.	
Plant Hagood	2–230,000 lbs./hr.
Plant Hagood	1–900,000 lbs./hr.
GULF POWER CO.	
Pensacola Station	2–230,000 lbs./hr.
Pensacola Station	1–325,000 lbs./hr.
UNION ELECTRIC CO. OF MISSOURI	
Ashley Street Station	2–285,000 lbs./hr.
Ashley Street Station	3–310,000 lbs./hr.
CENTRAL OHIO LIGHT & POWER CO.	
Woodcock Station	2–120,000 lbs./hr.
Woodcock Station	1– 90,000 lbs./hr.
Woodcock Station	2– 60,000 lbs./hr.
PENNSYLVANIA ELECTRIC CO.	
Williamsburg Station	1–300,000 lbs./hr.
CAROLINA POWER & LIGHT CO.	
Moncure Station	2–330,000 lbs./hr.

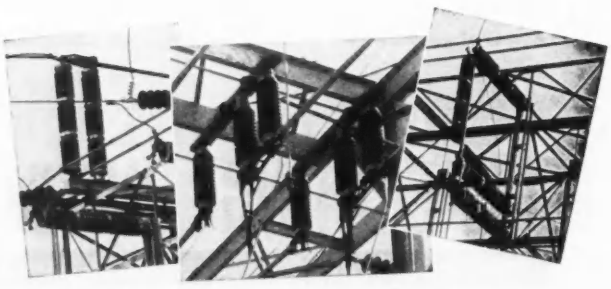
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS

FOR 20 YEARS . . .



The Lapp Station Post, incorporating the same design and performance characteristics as the Lapp Line Post, boasts an operating record unmatched by any other insulator for switch and bus support use.

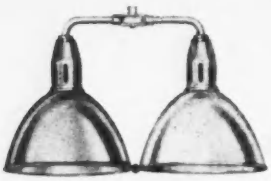
. . . DELIVERING AN EXTRA MARGIN OF OPERATING SECURITY . . . ELECTRICAL AND MECHANICAL

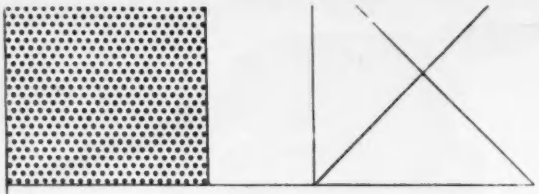
No insulator ever had a more severe baptism-under-fire, nor a better chance to prove its merits. The Lapp Line Post, the "radical" insulator design, promised to stand up where conventional insulators fail. It got its chance. In "trouble spots" from coast to coast. Its operating record has been built largely on installations in lightning areas . . . where stones and bullets . . . or atmosphere contamination . . . made insulation by conventional design next-to-impossible. The record now goes back 20 years. Long enough to prove our right to say . . . no puncture . . . no cracking . . . no cleaning . . . no radio interference . . . greater resistance to stones and bullets . . . better performance under arcover.

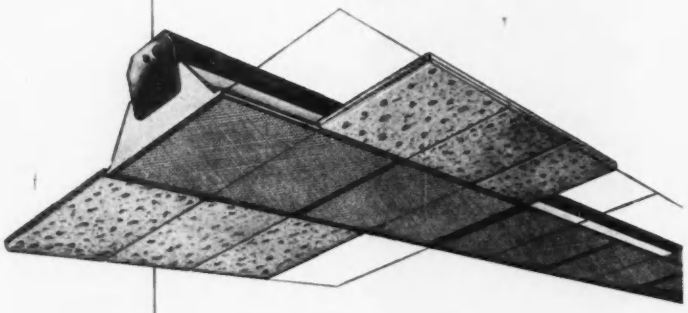
If you want to eliminate service interruptions . . . reduce manpower requirements . . . save maintenance costs . . . it's time to rewrite your standards and specifications, to call for Lapp Line Posts.

Lapp

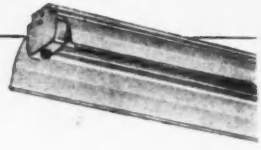
LAPP INSULATOR CO., INC., LE ROY, N.Y.







WHY MILLER RATES YOUR CONSIDERATION WHEN YOU ARE PLANNING LIGHTING



Because of experience — 107 years' pioneering and progress in GOOD Lighting. *Because of all-inclusive equipment* for the best use of all light-sources — Fluorescent, Incandescent and Mercury-vapor. *Because of wide acceptance* — America is dotted with Miller lighting installations in stores, offices, schools, factories, and public buildings. Miller Lighting Systems are built on an 8-Point QUALITY standard, designed to provide light of highest efficiency, and to give long satisfactory service. Engineering features make for easy installation and maintenance, and these make for LOW OVERALL COST (cost of equipment, installation and maintenance). You can light with confidence the *proven* Miller way. Miller field engineers and distributors are conveniently located for nation-wide service.

THE miller COMPANY MERIDEN, CONN.
SINCE 1844

ILLUMINATING DIVISION: Fluorescent, Incandescent, Mercury Lighting Equipment
HEATING PRODUCTS DIVISION: Domestic Oil Burners and Liquid Fuel Devices
ROLLING MILL DIVISION: Phosphor Bronze and Brass in Sheets, Strips and Rolls

KEARNEY Fuse Links

HAVE BECOME

the Industry's Preference..

because they are . . .

More Accurate for Truer Fusing

Have Truer Operating Characteristics

Designed in Four Speeds for Every Application

and Are Packaged in Color Identifying Cartons

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave., St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

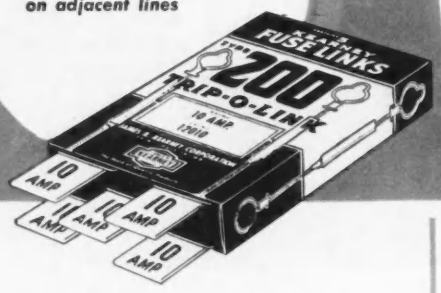
See following pages for more specific information about these popular Fuse Links.

Here They Are—

for EVERY APPLICATION...
COLOR IDENTIFIED to ELIMINATE
FUSE LINK CONFUSION

TYPE 200

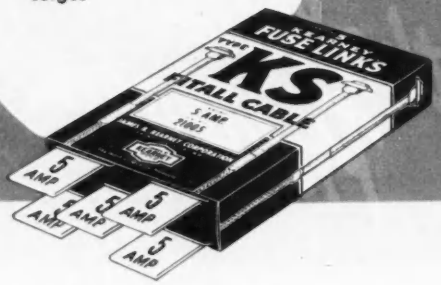
For prompt isolation of troublesome circuits—while maintaining service on adjacent lines



Certain circuits may prove to be more troublesome than others. When a line is subject to damaging long-time overloads and surges, continuity of service in adjacent circuits demands prompt action in isolating the troublesome line. This reliable protection is made possible by the accurate, durable characteristics of the pure tin used in the Type 200 Fuse Link. The low temperature operation of this link assures that overloads up to 150% of the fuse rating can be carried for one hour without damage to the fuse or fuse cutout.

TYPE KS

For reducing outages on circuits subject to switching and lightning surges



Where switching, motor-starting and lightning surges are common, maintain service by using the Type KS Fuse Link. Low temperature operation accommodates peak loads and dragging overloads with full protection to line equipment and without damage to the cutout. The overload capacities of the Type KS and Type 200 links are identical; however, the surge capacity of the Type KS fuse is twice that of the Type 200. In a thorough coordination plan, fuse links must coordinate not only with other fuses, but also with circuit breakers, and the slow speed characteristic of the KS link provides for the proper teamwork.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO

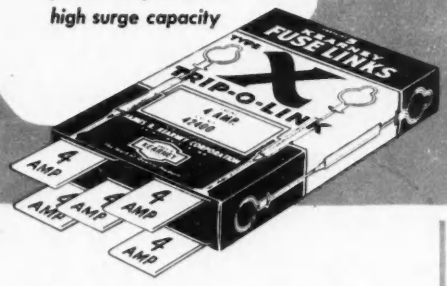
JAMES R. KEARNEY CORPORATION 4224-42 Clayton Ave., St. Louis 10, Mo.
Canadian Plant: Guelph, Ontario

SPECIFY KEARNEY PRODUCTS:..

KEARNEY Fuse Links

TYPE X

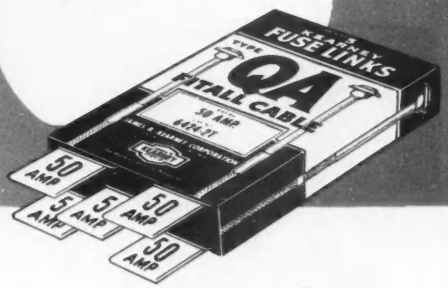
For distribution transformer overload protection plus extra high surge capacity



Designed to match the safe-loading curves of distribution transformers, the Type X Fuse Link keeps transformers in service during heavy overload periods and surges, and yet fuses in an instant when faults persist or reach damaging ranges. The extra high surge capacity means satisfied customers and lowered expense due to unnecessary outages. High tensile strength of Type X fuses prevents mechanical failure due to handling . . . a feature particularly important in fractional-ampere ratings. The Type X fuse is designed to carry full rated load continuously and to open 230% of rated current within 5 minutes.

TYPE QA

Designed to open 150% of rated load within 5 minutes



The QA link is designed to open at a lower percentage of rated current and therefore will fuse more rapidly than fuse links of the same ampere rating which have been designed to open 230% of rated load within 5 minutes. For working out coordination problems involving *all* Kearney Fuse Links, minimum melting and total clearing time-current curves on NEMA standard forms, together with fuse coordination charts, will be supplied upon request.

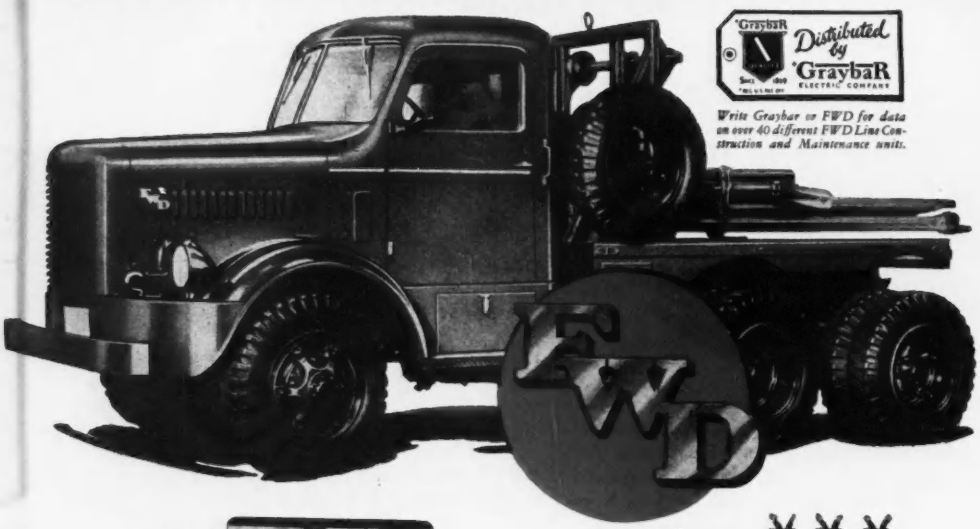
Keep the Right Link in the Right Place at the Right Time with a Kearney pole-mounted Fuse Link Dispenser.

-172

Better Construction – *SAFER* Maintenance

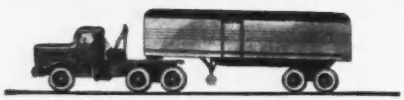
Choose a Multi-purpose FWD 6x6

Choose Ability to Speed up Construction and Maintenance



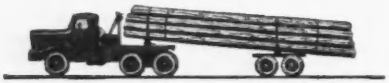
Distributed by Graybar Electric Company

Write Graybar or FWD for data on over 40 different FWD Line Construction and Maintenance units.



Got a "semi" with a transformer oil purifying unit? Haul it with an H 6 x 6. Fifth wheel recesses in platform.

Transporting heavy transformer is no problem with a low-bed trailer and a powerful FWD H 6 x 6 on the job.



You can take the trouble out of big pole hauling. Bolster fits H 6 x 6 platform quickly and easily.

You can make a train-hitch job for bulky trailer loads. H 6 x 6 platform is free for other equipment.

You'll find FWD H 6 x 6 a sound answer to the need for a multi-purpose utility unit. FWD's extra traction means added safety with better distribution of weight and power—easier going on or off the road. But you'll want to get the complete story on FWD completely-equipped, utility-engineered units.

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wis. • Canadian Factory — Kitchener, Ontario

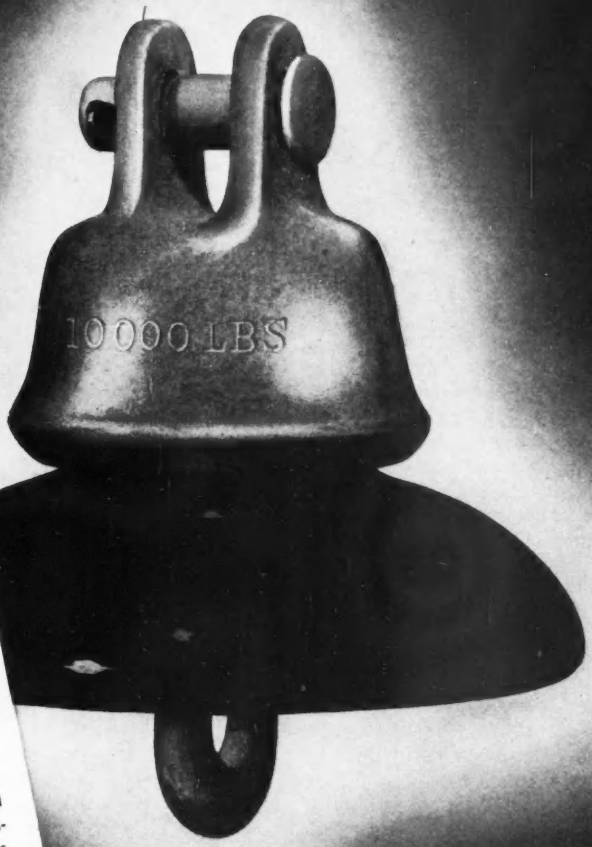
World Wide Sales and Service

America's Foremost Heavy-Duty Truck

LOCKE

presents masterpieces of

insulator engineering



Perfection

...in low voltage suspensions typified by

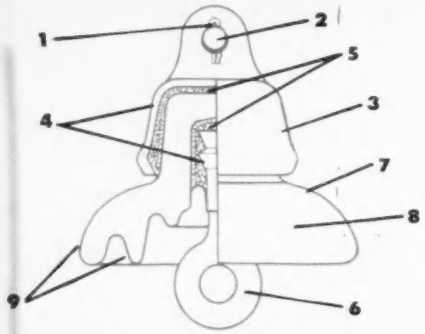
LOCKE'S

No. 16583

Take this step toward further reducing your cost per kilowatt hour. Test Locke's Low Voltage Suspensions on a dollars-and-cents basis. You'll find that excellence of design and manufacture enable them to generally out-perform all others. This, of course, is the reason why utilities have specified them by the tens of millions since their original development in 1904.

Presenting A MASTERPIECE OF INSULATOR ENGINEERING

The LOCKE low voltage Suspension Insulator



You get ALL these advantages in this LOCKE DESIGN

1. Humped cotter key saves time and labor because linemen can install and remove cotter bolt faster, easier.

2. High strength cotter bolt assures service continuity.

3. Top quality forged steel or malleable iron caps, and forged eyes . . . add years of dependable service to the insulator.

4. Corrosive action on metal parts due to action of cement is eliminated because these surfaces are coated with a special non-hardening, resilient coating. This coating not only acts as an expansion joint which eliminates breakage due to temperature changes, but it also helps distribute loads efficiently.

5. Locke Compression Sand, applied at both cement joints, gives added strength and stability to the insulator.

6. Hot line work is greatly simplified because ample clearance is provided between the eye and the porcelain . . . and because of the humped cotter key at the top of the insulator.

7. The possibility of breakage, caused by thermal shock and mechanical impact, is greatly lessened because porcelain surface is covered with Locke Compression Glaze.

8. Because Locke Wet-Process porcelain is used throughout, the insulator is fully capable of withstanding power arcs, lightning flashovers and extremely rough handling.

9. You get highly satisfactory performance during electrical storms and rains because of adequate flashover ratings . . . and maximum leakage distance.

YOU ARE EQUALLY SURE of getting a masterpiece of design when you specify other products in the complete line of Locke Insulators and suspension hardware. Each pays off in superior performance on transmission and distribution lines, generating stations, sub-station and electrical apparatus. Locke Department, General Electric Company, Baltimore, Maryland.

LOCKE

LOW VOLTAGE PIN TYPE INSULATORS

HIGH VOLTAGE PIN TYPE INSULATORS

SUSPENSION INSULATORS

SWITCH & BUS INSULATORS

SPOOL INSULATORS

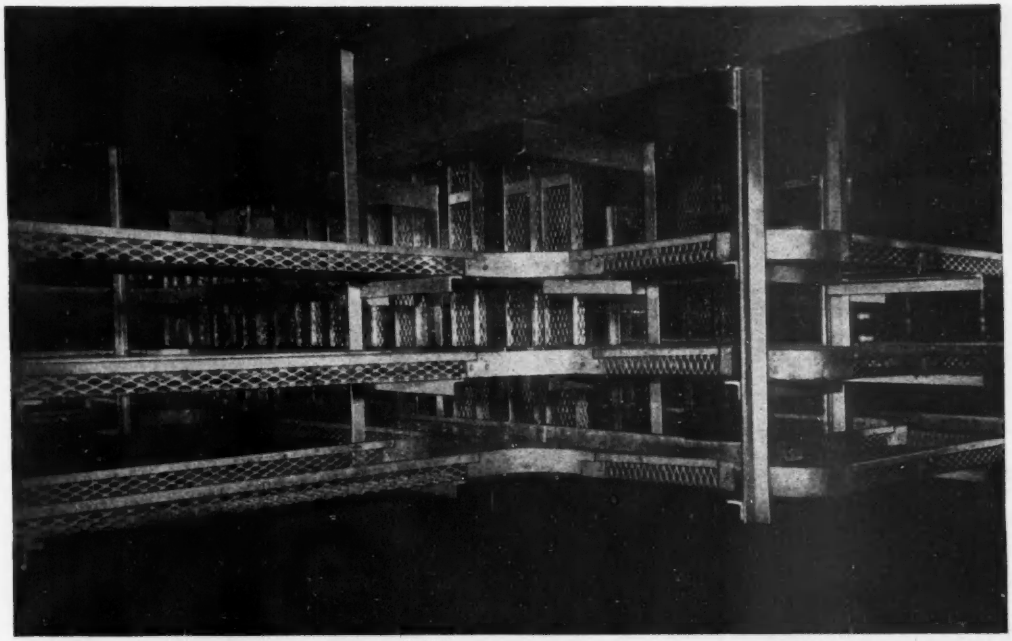
GUY INSULATORS

LIQUID-FILLED BUSHINGS

SUSPENSION & STRAIN CLAMPS

SUSPENSION HARDWARE

ENTRANCE BUSHINGS



The NEW Cope Cable Trough Enables You To CUTS COSTS UP TO 66⅔%

An outstanding utility company reports that on a large job their installation of Cope Cable Trough saved them 66⅔% of the cost of a conduit installation!

Savings are always made when Cope Cable Trough is used—real savings in material, labor and costs.

Such savings are not only necessary at all times, but doubly so during our Country's State of Emergency.

In most cases Design Engineers can order standard Cope Cable Trough and Fittings for a complete installation job, but in cases where special fittings are required they have Cope Engineers to help solve their problems. The elimination of costly engineering—the ease of installation—man-hour reduction—all of these factors reduce costs and increase savings through the use of Cope Cable Trough.

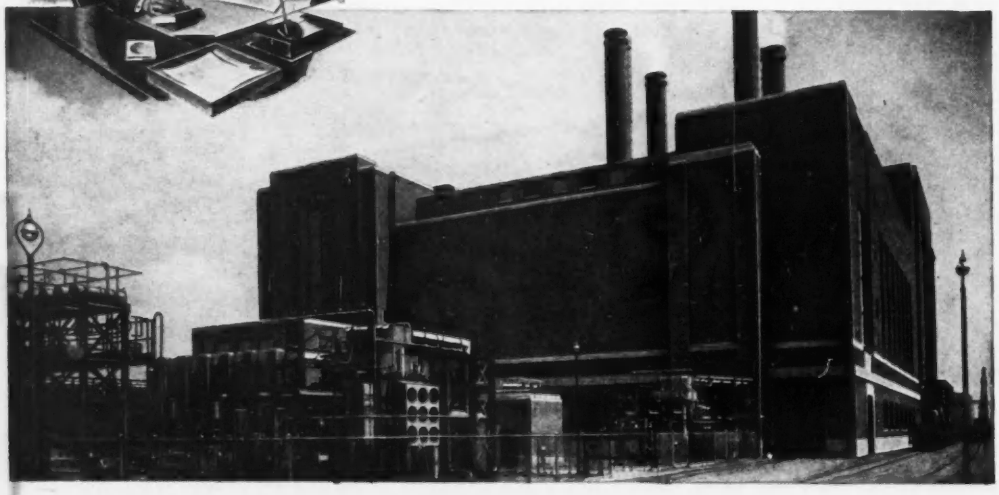
If you want to save—and you *will* save—write now for the detailed bulletin on Cope Cable Trough.

You know Cope by these Products . . .

T. J. Cope INC.

T. J. COPE, INC., 711 SOUTH 50th ST.
PHILADELPHIA 43, PENNSYLVANIA

"My bet's on Bituminous—



—the kind that is mined on the B&O!"

Take a tip from executives who think in terms of fuel economy and dependability of supply. These men design their plants for the efficient coals mined in B&O territory.

These coals, available in wide variety for all needs, lend themselves to mechanized, low-cost mining. As they are located close to America's industrial heart, transportation costs are moderate. And because their sources are *known* and *definite*, they can be depended upon —*even during wartime*—for centuries to come.

Backing its faith in Bituminous, the B&O has made large capital investments in its properties. The result will be even more efficient service for the Bituminous industry and its customers.

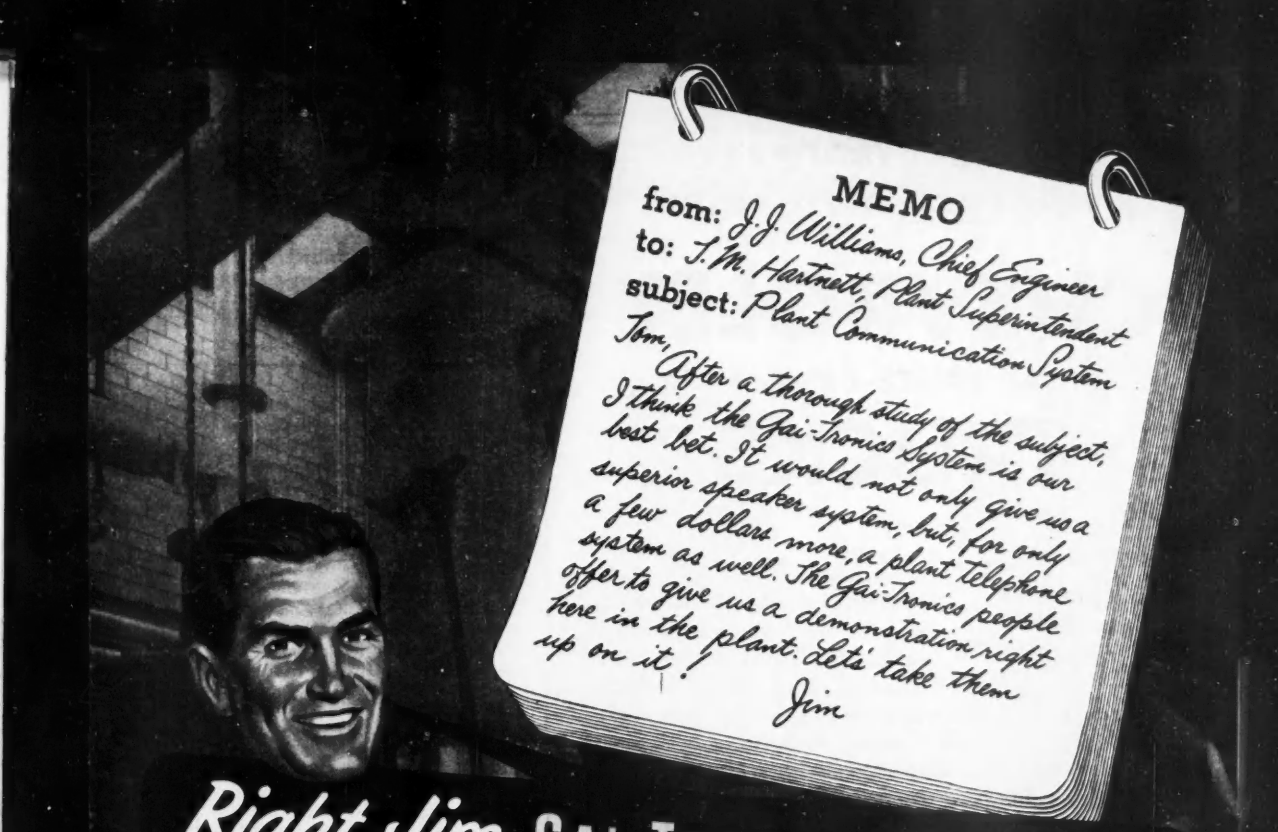
Ask Our Man!

BITUMINOUS COALS FOR EVERY PURPOSE

from modern mines like this—→

BALTIMORE & OHIO RAILROAD

Constantly *doing things*—**better!**


MEMO
from: J. J. Williams, Chief Engineer
to: T. M. Hartnett, Plant Superintendent
subject: Plant Communication System
Tom,
After a thorough study of the subject, I think the Gai-Tronics System is our best bet. It would not only give us a superior speaker system, but, for only a few dollars more, a plant telephone system as well. The Gai-Tronics people offer to give us a demonstration right here in the plant. Let's take them up on it!
Jim

Right, Jim, GAI-TRONICS GIVES YOU TWO COMMUNICATION SYSTEMS IN ONE

Only by choosing a GAI-TRONICS Power Plant Communication System, can you get a *complete* system—far more versatile than an ordinary public address hookup with an unhandy, separate intercom.

GAI-TRONICS Systems are *custom-engineered* by Power Plant Design Engineers—men who know the problems and needs of top-notch power plant communication. GAI-TRONICS speakers and telephone handsets are specially designed for power plant operation. Even under the highest and most unusual noise levels, hearing and speaking are easy, completely unstrained.

With but a flick of a switch it is possible to change from speaker use to personal two-party or group telephone conversation. No need for two individual systems—each with its own wiring, devices, maintenance, *and expense!*

To everyday power plant operation, GAI-TRONICS brings a new standard of efficiency. During an emergency, *fast, sure* GAI-TRONICS communication can avert disaster—can more than pay for itself in a few minutes.

FREE

We want you to know more about GAI-TRONICS. At your request, we will send you an informative booklet . . . *Power Plant Communication Systems.* OR, we will be glad to give you an eye-opening demonstration with a portable GAI-TRONICS System *in your plant!* Write today!

GAI
FOUNDED 1906

You get more . . . you save more with

CHEVROLET

ADVANCE-DESIGN

TRUCKS

Whatever the job you have for a truck, Chevrolet has the truck that's *right* for your job! It's a new Chevrolet Advance-Design truck, built to cut your trucking costs down to rock bottom. Saves you money when you buy, because the purchase price is low. Saves money right along, because no other truck in its price class offers the great combination of *ruggedness, durability and economy* you get in Chevrolet. Just look at the extra value features that make Chevrolet trucks *stand up better, handle easier, cost little to run and maintain.* Your best truck deal is the deal you get on a Chevrolet Advance-Design truck at your Chevrolet dealer's.

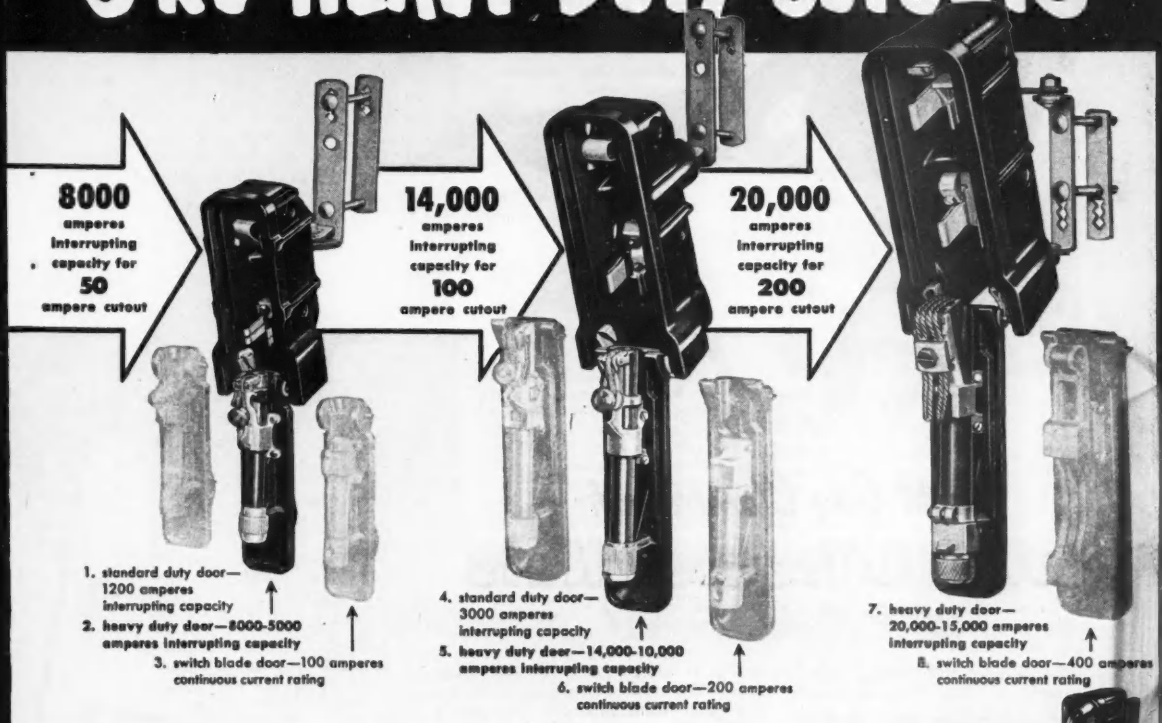
CHEVROLET DIVISION OF GENERAL MOTORS
DETROIT 2, MICHIGAN

CHEVROLET

ADVANCE-DESIGN TRUCK FEATURES

TWO GREAT VALVE-IN-HEAD ENGINES—the 105-h.p. Loadmaster or the 92-h.p. Thriftmaster—to give you greater power per gallon, lower cost per load • POWER-JET CARBURETOR—for smooth, quick acceleration response • DIAPHRAGM SPRING CLUTCH—for easy-action engagement • SYNCHRO-MESH TRANSMISSIONS—for fast, smooth shifting • HYPOID REAR AXLES—for dependability and long life • NEW TORQUE-ACTION BRAKES—for light-duty models • PROVED DEPENDABLE DOUBLE-ARTICULATED BRAKES—for medium-duty models • NEW TWIN-ACTION REAR BRAKES—for heavy-duty models • NEW DUAL-SHOE PARKING BRAKE—for greater holding ability on heavy-duty models • NEW CAB SEATS—for complete riding comfort • NEW VENTIPANES—for improved cab ventilation • WIDE-BASE WHEELS—for increased tire mileage • BALL-TYPE STEERING—for easier handling • UNIT-DESIGNED BODIES—for greater load protection • ADVANCE-DESIGN STYLING—for increased comfort and modern appearance.

Here is L-M's complete line of type PHD 5 KV HEAVY DUTY CUTOUTS


8000 amperes interrupting capacity for 50 ampere cutout
14,000 amperes interrupting capacity for 100 ampere cutout
20,000 amperes interrupting capacity for 200 ampere cutout
1. standard duty door—1200 amperes interrupting capacity
2. heavy duty door—8000-5000 amperes interrupting capacity
3. switch blade door—100 amperes continuous current rating
4. standard duty door—3000 amperes interrupting capacity
5. heavy duty door—14,000-10,000 amperes interrupting capacity
6. switch blade door—200 amperes continuous current rating
7. heavy duty door—20,000-15,000 amperes interrupting capacity
8. switch blade door—400 amperes continuous current rating

Up to 20,000 amperes interrupting capacity

Interchangeable Doors—standard, heavy duty, and switch blade types—in each rating

50 and 100 ampere doors fit your present PVD® cutouts

Here is the first and only complete line of cutouts for high power capacity distribution feeders. These cutouts provide extra high interrupting capacity *as you need it*, without the extra cost for needless high *continuous* current rating. You can install one of these new L-M cutouts with standard duty door. As feeder load requirements change and fault currents increase, you can change it to a heavy duty cutout, in just six seconds, by hooking on the heavy duty door. Or change it to a disconnect switch—either stationary or indicating. Or you can change over your *present* PVD's! Warehousing and stocking are simplified, costs are cut.

PHD is a Line Material Co. trademark.

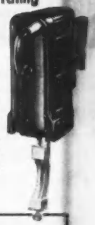
OUTSTANDING DESIGN FEATURES

- Housings wet-process porcelain, glazed inside and out.
- Hanger supports cemented into back of porcelain housings.
- All current carrying parts silver plated.
- New clamp type terminals with easily accessible large-head screws.
- Replaceable "bakelined" fuse cartridge tubes resist weathering and arcing.
- Spring-actuated flip-out device pulls fuse link down and out of tube, assuring instant separation of link parts, even with the smallest links, and low fault currents.

ENGINEERED FOR SAFETY—The lineman can remove the door completely, re-fuse and replace it, all with a switch stick. When door is open, all door parts are dead.

400 ampere disconnect switch in indicating position

Through the use of this new, higher-rated switch blade, the 200 ampere cutout can now be converted simply and quickly to a 400 ampere disconnecting switch for use on higher nominal current systems. Door can be closed with hinged blade in disconnect position below the box, giving positive indication that the line is open—a unique L-M feature.



L-M HEAVY DUTY CUTOUTS

RATING	DOORS AVAILABLE	INTERRUPTING CAPACITY rms amperes 2.5 kv*	5 kv**
50 AMPERES	1. Standard duty, indicating	1,200 amp.	1,200 amp.
	2. Heavy duty, non-disconnecting	8,000 amp.	5,000 amp.
	3. Switch blade	100 amperes continuous current rating.	
100 AMPERES	4. Standard duty, indicating	3,000 amp.	3,000 amp.
	5. Heavy duty, non-disconnecting	14,000 amp.	10,000 amp.
	6. Switch blade	200 amperes continuous current rating.	
200 AMPERES	7. Heavy duty, indicating	20,000 amp.	15,000 amp.
	8. Switch blade	400 amperes continuous current rating.	

* or line-to-neutral 4160 or 4330 volts Gr. Y. ** or line-to-neutral 8330 volts Gr. Y.

GET THE WHOLE STORY—Ask the L-M Field Engineer for complete information, and copy of Bulletin on PHD Cutouts; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

55

LINE MATERIAL . . . fuse cutouts

Complete Coordinated Equipment for Distribution Today

Now you get DOUBLE holding power

L-M Guy Clamps with TORKOL-Treated Nuts Work Faster, Easier!

Now you can use *one* guy clamp where you formerly used two! Tests show that with Torkol nut lubricant—an L-M "exclusive"—wrench torque develops twice the normal holding power of an untreated clamp. High strength, heat-treated bolts assure plenty of extra strength.

THESE TESTS TELL THE TORKOL STORY

Recent tests compared the holding power of Torkol-treated 3-bolt clamps with untreated 3-bolt clamps. The pull required to produce ⅛-inch slip of the guy strand was measured for a wide range of wrench-torque values. Results were plotted into comparative "Nut-Torque vs. Holding Power" curves shown at the right.

SEE WHAT A DIFFERENCE!

To hold a pull of 7000 pounds, using ⅜" high strength guy strand and clamps with ⅝" dia. bolts, required the following nut torques:

with *un*treated clamps, 120 foot-pounds torque;

with Torkol-treated clamps, 52 foot-pounds—less than half as much!

The extra holding power of L-M Torkol-treated guy clamps often permits the use of a clamp with smaller bolts. For example: With 3-bolt clamps with ⅝" bolts, on ⅜" HS strand, with 90 foot-pounds of torque:

*un*treated clamp held a 5800-pound pull;

Torkol-treated clamp held 12,400 lbs.

With a 3-bolt clamp with ½" bolts:

*un*treated clamp held a 3800-pound pull;

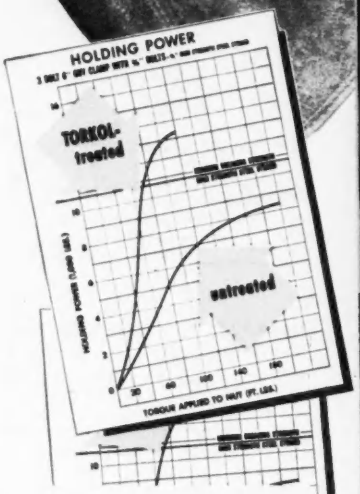
Torkol-treated clamp held 9700 pounds.

The Torkol-treated clamp with ½" bolts held 3900 pounds more than the untreated clamp with ⅝" bolts! The possible savings are obvious.

SERVES YOU BETTER—COSTS NO MORE

With L-M Guy Clamps, you save on material, cut installation time, and get far better strength-balance in the whole guying installation. What's more, Torkol-treated L-M clamps contribute to worker-safety, for they seldom require heavy muscular effort with its risks of straining and danger. *And L-M Torkol-treated clamps cost you no more!*

Torkol is a Line Material Trademark



GET THESE NEW FACTS ON "TORKOL"

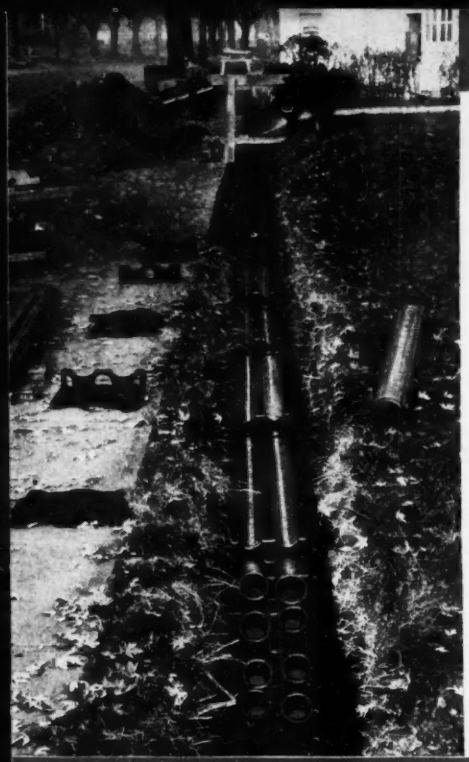
Want a complete set of these new Torkol test curves? Eight charts cover the guy-strand range from ¼" to ½"—and permit coordination of guy clamp holding strength with that of other components. Ask your L-M Field Engineer, or write Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

L-M Guy Clamps are made in styles from one to four bolts, of heavily galvanized steel. Smooth grooves with rounded edges prevent strand damage. The high-strength bolts may be inserted from either side.

All nuts are Torkol-treated—identified by their yellowish color. They go on quickly, stay tight, unscrew easily, may be reused. Clean. Dry. Unaffected by weather or weather changes.

LINE MATERIAL
Line Construction Materials

Complete Coordinated Equipment for Distribution Today



for faster underground installations

New L-M Spacers

New L-M Base Spacer:

assures rigid foundation, desired gradient. Interlocking ends; wide flat base—the spacer will not tip over during or after installation. All L-M spacers come in standardized cartons to save stockroom handling and space. Available from stock, in six standard sizes.

New L-M Intermediate Spacer:

made of asphalt and asbestos fibre, highly resistant to acids and alkalis, fire resistant, Underwriters' listed. Withstands vertical flat crushing test of over 1200 pounds. Grooved ends lock together with the next spacer; centers notched for sawing.

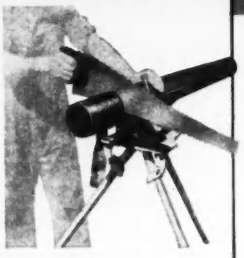
New L-M Bend Spacer Bar:

a duct-installation leveller, used horizontally or vertically for accurate alignment of conduit around bends. Saves hours of work in lining up. Offers a tremendous saving in installation labor costs. L-M exclusive. 20" long, 1½" square, easily sawed to length.

New L-M Multi-Use Bend Sections and Angle Couplings:

use in any combination to make all kinds of special bends and crossovers. Male and female tapers offset 2½°, giving 5° bend in each section. Smooth inside, watertight tap-tite joints.

The L-M System makes Fibre Conduit *so easy to use*



New L-M Fibre Conduit Vise

An easy, safe way to hold fibre conduit for sawing or tapering. For mounting on truck or bench, or with detachable tripod for use in the field, on the job.

With L-M Fibre Conduit and L-M equipment and tools, L-M's system speeds up underground installations, makes better jobs.

L-M Fibre Conduit is strong, light, tough; yet it's easy to taper and cut to length. L-M base spacers, intermediate spacers, and bend spacers assure a firm foundation and a rigid structure that won't settle or shift.

L-M tools save hours of time in the shop and on the job. Better get the low-down on this high-class, time-saving equipment.

GET THIS FREE HANDBOOK! Pocket-size manual covers recommended underground construction practices; contains valuable reference tables. Ask the L-M Field Engineer for a copy, also for new Fibre Conduit folder; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

New L-M Tapering Tool

Cuts a precise 2° taper on the end of conduit to assure tight, snug joints. Light; easy to use; saves time; cuts costs by salvaging cut ends and short lengths quickly.

36

LINE MATERIAL ... Fibre Conduit

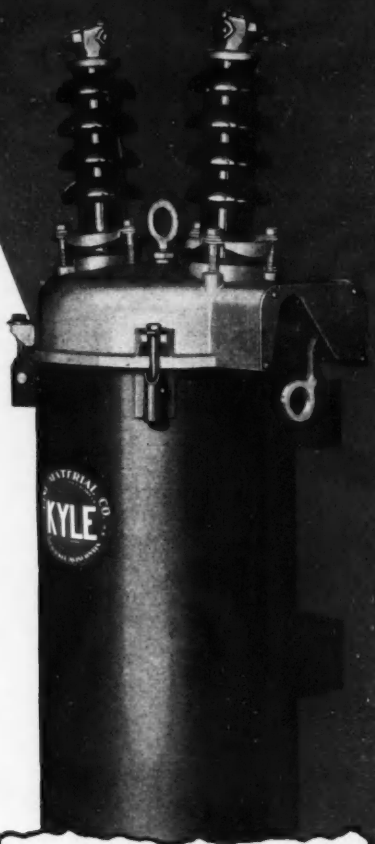
Complete Coordinated Equipment for Distribution Today

KYLE

TYPE "L" OIL CIRCUIT RECLOSER NOW GIVES YOU UP TO

6000 amps interrupting capacity

IN NEW 140-AMP RATING



First recloser actually engineered for heavy-duty service ... full power-class design ... 110 kv insulation impulse level ... ratings up to 140 amps ... only real heavy-duty recloser in its class

Kyle type "L" reclosers cost a little more than lighter-duty reclosers, but they're worth the difference in service, performance, convenience, and freedom from maintenance. Even if you don't need the extra interrupting capacity now, you will need it to take care of future loads; and in the meantime you enjoy all the benefits of type "L" performance and economy.

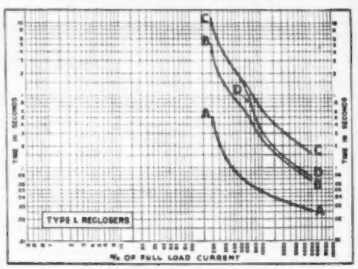
It's the Kyle oil cross-blast method of arc extinguishing, plus heavy-duty design, that makes it possible for the "L" to handle heavy fault currents up to 6000 amps.

The type "L" is the only recloser with so wide a choice of operating sequences. Four standard curves permit any sequence of operation to meet your coordination problems.

Sequence and coil changes are made right in the field—in a few minutes. To change to a coil of different rating, you just remove two screws. To change operating sequence, simply rotate a disc or change one small part. It's quick—and easy! Saves shop trips!

Extremely accurate; virtually no effect from ambient temperature changes. Positive fast operation; positive toggle closing—doesn't depend on gravity. Many safety features: cover and tank electrically dead—bushing tops only live parts; trip-free operating handle. Large sleet hood protects counter and operating handle; may be rotated in 90° steps. Rugged; shock-proof; trouble-free.

ONLY RECLOSER WITH 4 OPERATING CURVES



RATINGS

Coil Rating Amperes	Min. Trip Current Amperes	Maximum Interrupting Capacity Amperes At Maximum Phase-to-Phase Nominal Voltage of		
		4.8 kv	7.2 kv	14.4 kv
25	50	1500	1500	1500
35	70	2100	2100	2100
50	100	3000	3000	3000
70	140	4200	4000	3000
100	200	5000	4000	3000
140	280	6000	4000	3000

Read all about it!

Ask the L-M Field Engineer for a copy of Bulletin CR1A—on the type "L"; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

18

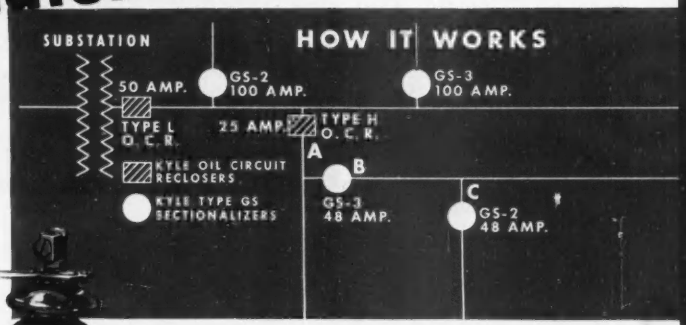
LINE MATERIAL... Kyle Reclosers

Complete Coordinated Equipment for Distribution Today

How to make rural line protection fully automatic...

KYLE

type GS automatic oil sectionalizers



Completely automatic from substation to branch

Sectionalizers coordinate with reclosers to isolate branch lines on permanent faults. They are not current-interrupting devices. They open only while the recloser contacts are open. They are pre-set to lock out after the first, second, or third operation of the recloser.

In the diagram, A is the recloser. B is a Kyle sectionalizer set to open during the *third* operation of the recloser (indicated by GS-3). C is set to open after the *second* operation of the recloser. If a fault occurs beyond C, recloser A operates. If the fault doesn't clear on the first operation, the recloser opens again, and Sectionalizer C opens, isolating the tap. Then the recloser re-energizes the rest of the branch.

If a fault occurs *between* B and C, Sectionalizer C does not operate. But if the fault has not cleared by the third operation of the recloser, Sectionalizer B opens, isolating that branch. The recloser then re-energizes the rest of the line.

Other branches are also protected by Kyle sectionalizers which are opened by the 50-amp type L recloser at the substation.

ALL THE KYLE SAFETY FEATURES

Tank, cover, and operating handle electrically dead. Tank may be grounded. Mechanism cooled, and insulated from tank, by transformer oil. Trip-free operating handle—cannot impart a blow to operator.

RATINGS

Seven sizes, with minimum tripping currents 8 to 100 amps to coordinate with reclosers rated from 3 to 100 amps. Maximum operating currents 150 to 2000 amps, 2.4 to 15 kv. Weight with oil about 25 pounds. Cressarm or direct pole mounting.

ISOLATES permanent faults on branch lines...

COORDINATES with any make or type of recloser...

COSTS LESS to operate than fuses...

The Kyle type GS sectionalizer opens only on permanent faults that the recloser cannot clear; it provides completely automatic protection and positive coordination by eliminating the human element in installing the correct fuse; and while the GS costs more than a single-shot cutout, it saves far more than the difference, in time and service calls.

Because sectionalizers do not interrupt current, there is no arc to wear contacts or cause oil contamination. Sectionalizers cannot be used independently, but only with reclosers—of *any* make or type.

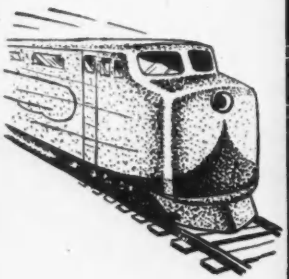
Ratings are changed in the field by replacing the trip coil. Lockouts are pre-set by changing the lockout adjustment pin—a matter of a few minutes. After a permanent fault has been corrected, the sectionalizer is manually reset with the operating handle.

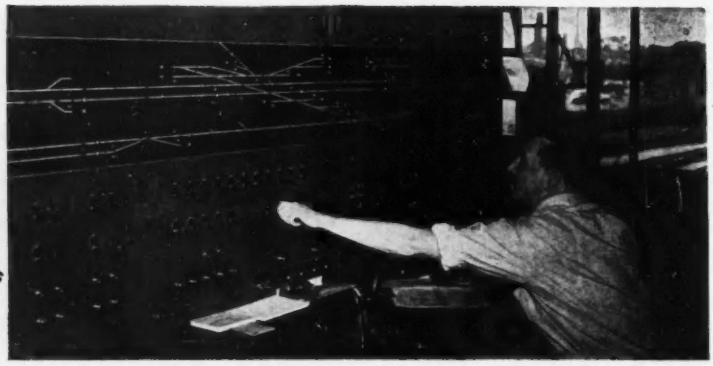
Get the Whole Story

Ask the L-M Field Engineer to explain complete, automatic protection, and to give you a copy of Sectionalizer Bulletin CR3. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL...Kyle Sectionalizers

Complete Coordinated Equipment for Distribution Today





REACHING OUT 20 MILES TO LEAD A TRAIN

Railroad signal and communication engineers require dependability above all other things in the equipment which they buy. When it comes to signal cables, which are the vital connecting links between control machines and signals, they have a serious problem. If the cables are installed in the air they are subject to cinders, sparks, heat, sunlight, sleet and rain. If they are installed underground, the cables must be able to withstand long-time exposure to water, soil acids and alkalies, vibration from passing trains, and the cutting effect of sharp cinders. This is brutal punishment. So how to get trains through safely and on time — not once, but every day in the year?

Fortunately, long before the railroads started to use CTC (Centralized Traffic Control) Simplex had developed an insulation that had excellent properties for signal and communication work and was dependably water resistant. That solved the moisture problem. The use of especially compounded neoprene as a jacketing material solved the problem of how to combat sparks, heat, sunlight, rain, etc. This is a typical example of how Simplex Research helps to provide just the right cable for the job.

Simplex Research gave you the first heavy duty, rubber-jacketed portable cord or cable; the first low water absorption insulation; the first rubber-jacketed underground cable. Besides these notable "Firsts" Simplex Research has provided a great many developments which have enriched the art of cable design.

SIMPLEX-ANHYDREX IS A PRODUCT OF SIMPLEX RESEARCH

SIMPLEX-ANHYDREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

BIDDLE
Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

NUMBER 8 OF A SERIES

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

MAKE ELECTRICAL RESISTANCE MEASUREMENTS
from a Fraction of an Ohm up to 1000 Megohms

with the BRIDGE-MEG® Insulation and Resistance Tester

Designed to provide maintenance men with a complete multi-purpose instrument, the Bridge-Meg type of Megger® Insulation and Resistance Tester combines the facilities of a Megger Insulation Tester and a Wheatstone Bridge. The Varley Loop feature may be added for locating faults on wires. Here is how it works:

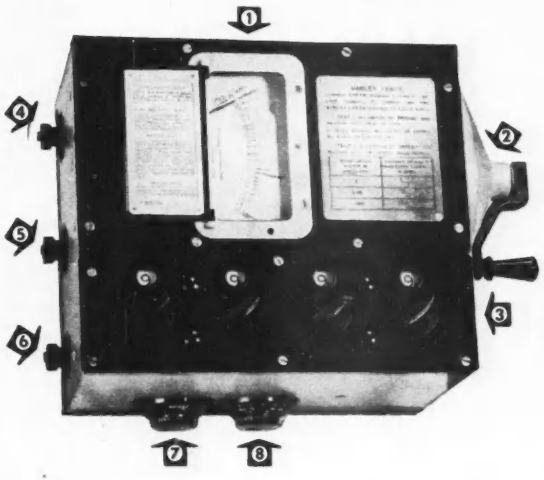
1. Scale—reads directly in ohms and megohms for insulation resistance tests. The pointer "floats" near infinity until the hand generator is operated.

2. Constant-Voltage Hand Generator—supplies direct current at rated voltage (up to 1000) for insulation resistance tests and at about one-third rated voltage for Wheatstone Bridge measurements. Simply turn the crank at about 160 rpm.

3. Wheatstone Bridge Resistances—adjustable dial decade resistance units each reading 0 to 9, giving a total of 9999 ohms for Bridge measurements, or the setting of the ratio switch. Each dial clicks from one position to the next and the figures show plainly through small windows in the top of the instrument.

4 & 5. Testing Terminals—these two terminals are used for both insulation tests and Wheatstone Bridge measurements of conductor resistance, according to the position of the changeover switch.

6. This terminal is included in instruments having the Varley Loop feature and is for the Varley Earth connection when locating faults.



7. Change-Over Switch—a multi-position rotary switch for changing internal connections between insulation resistance tests, Wheatstone Bridge measurements and the Varley Loop connection.

8. Ratio Switch—indicates whether the Wheatstone Bridge resistance dial readings should be: ÷ 100, ÷ 10, × 1, × 10, or × 100.

For more complete information we will mail you Bulletin 21-60-W

ARE YOU SURE OF PROTECTION THROUGH YOUR GROUND CONNECTIONS?
Biddle Ground Tester measures low resistance

Photo Courtesy Copperweld Co.

In spite of apparently good lightning rod or arrester protection, lightning frequently will cause severe damage if high ground resistance hampers its dissipation in the earth. The season for lightning storms is returning to the northeastern states. Now is the time for plants in this section to make a thorough round of ground resistance tests. Aside from the hazards to personnel, thousands of dollars may be saved in damage to electrical equipment and in loss of power and stoppage of production.

The MEGGER® Ground Tester is the easiest, quickest and most accurate method of determining ground resistance. It is an instrument specially designed for the purpose and should be used wherever possible. Direct readings are automatically obtained in ohms. It provides its own source of current—no batteries, or other remote source required. It's easy to carry, too. Has approval of the Associated Factory Mutual Insurance Companies.

Don't put it off—write today for "Grounding Electrical Circuits Effectively" by J. R. Eaton (Bulletin 25T-W) and our Biddle manual on "Ground Resistance Testing" (Bulletin 25J-W).

HERE'S A "GOOD COMPANIONS" KIT FOR PRACTICAL ELECTRICAL ENGINEERS AND MAINTENANCE MEN

Men concerned with all-around-the-plant electrical tests and resistance measurements tell us that these are "indispensable" tools:

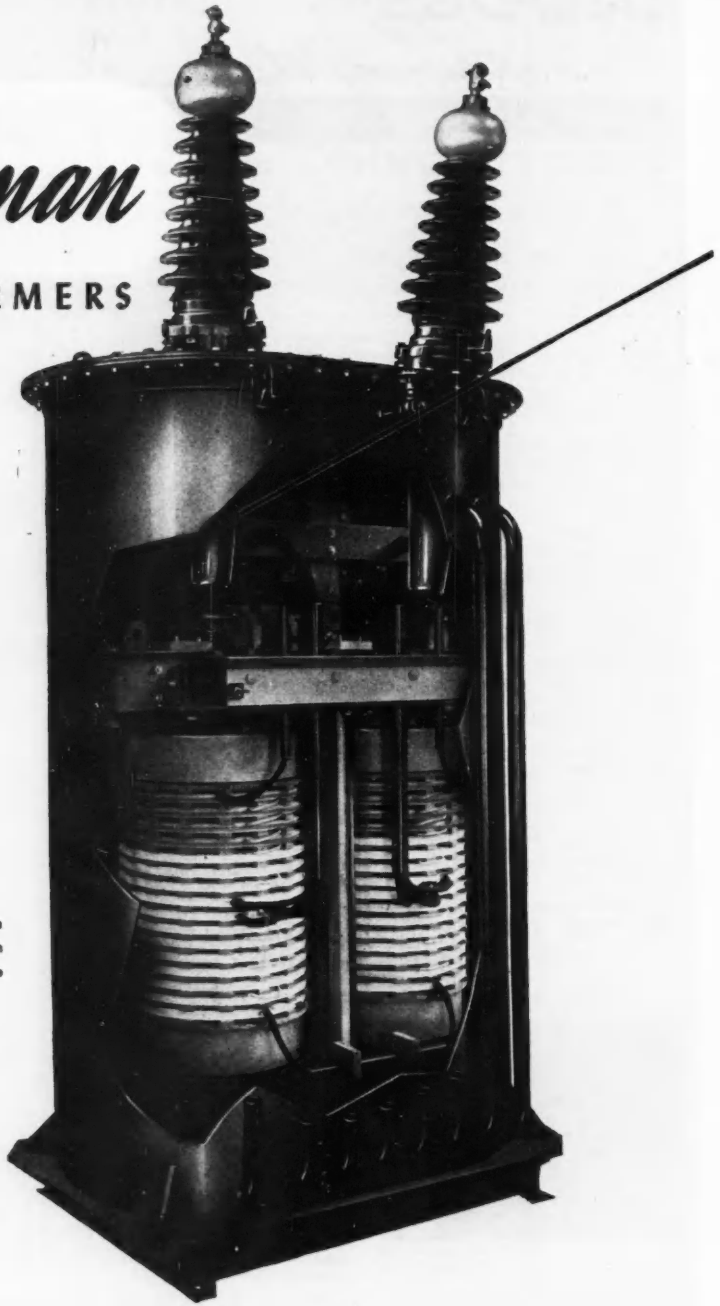
Midget Megger® Insulation Tester for detecting dirt, moisture and deterioration in advance of failure, or as a trouble-shooter after failures occur.

The Midget Megger Circuit Testing Ohmmeter for measuring conductor resistance of coils, contacts and relays, and checking continuity of circuit and grounded parts.

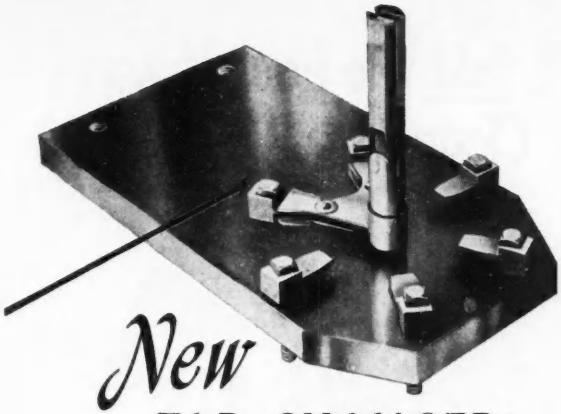
Be sure to write for your copy of 21-85-W today.

Kuhlman

TRANSFORMERS



Core type 333 KVA Kuhlman distribution transformer, high voltage 67000, low voltage 2400.



New

TAP CHANGER

HAS IMPROVED CURRENT CARRYING CAPACITY, ...IS SELF-CLEANING

Improved current carrying capacity and self-cleaning of contact blades are major features of this new Kuhlman tap changer, now standard equipment on all Kuhlman transformers 167 KVA and above, single phase, and 225 KVA and above, three phase. These important advantages are achieved by self-aligning spring clips on rotary blades which engage heavy stationary blades, providing positive double surface contact under substantial pressure. High creepage resistance and permanent alignment of contacts is assured by the use of a special low power factor non-warping phenolic laminate in the tap changer board.

This is another example of Kuhlman's restless engineering talent, which is continually on the outlook for new methods, new features, new materials. Some other famous Kuhlman Firsts: the Bent Iron Core, pioneer of the wound core types; the oil impregnation of transformer coils; the use of varnish in place of compound impregnation materials; the developing of the forerunner of the present day series multiple transformer; the clamp type bushing terminal which eliminates use of tools in making primary connections.

All of these Kuhlman developments have been adopted in one form or other by progressive transformer manufacturers. Kuhlman is proud of this fact, feels it is a tribute to its engineering genius and manufacturing inventiveness. It's an indication, too, of the type of product you get when you specify Kuhlman transformers.

Kuhlman **ELECTRIC COMPANY**

BAY CITY, MICHIGAN

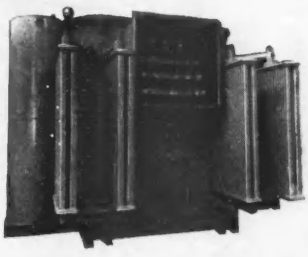
Export Representatives:
International Standard Electric Corporation
67 Broad Street, New York 4, N. Y.
Cable Address, Microphone, N. Y.

A complete transformer line for ALL your needs. Write for new Kuhlman bulletins on Distribution, Power, Dry Type, Street Lighting and Specialty units.

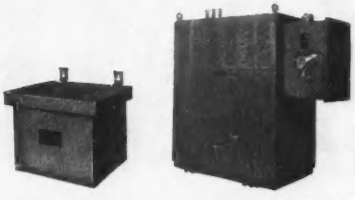
A KUHLMAN TRANSFORMER FOR YOUR EVERY NEED!

KUHLMAN CONVENTIONAL TRANSFORMERS

KUHLMAN CSP TRANSFORMERS

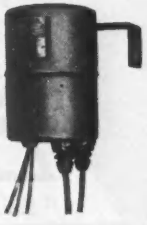


KUHLMAN POWER TRANSFORMERS



KUHLMAN DRY TYPE TRANSFORMERS

KUHLMAN SAF-T-KUHL TRANSFORMERS



KUHLMAN STREET LIGHTING TRANSFORMERS

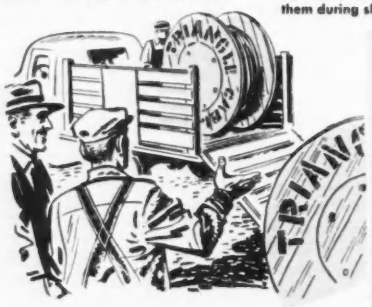
103

I told the boss it was Clean as a Whistle!

It was a big atomic energy job and we wanted everything to be just right. "Is this stuff clean?" asks the boss, eyeing a rack of conduit. I told him it was Triangle and *it had* to be right but he wanted to see for himself. "Good—no burrs, no rough spots and it's hot-dipped galvanized. That's the kind of conduit I like to see."

I figured while I had him in a good mood, I'd give him the rest of the story. "See how easy it bends, nice and even all around and there's no flaking on the bends. You never get any broken threads either because Triangle makes conduit and couplings the right way and the threads are capped to protect them during shipment."

I took him over to where we were doing some branch circuit work. "Pulling wire is a cinch with Triangle's Glazon. That slick braid sure helps to do the trick. Glazon seems to be extra tough, too. Stands up better than anything we've ever used."



The boss asked me what kind of service I was getting and I told him, "Triangle and their distributors have never let me down. I don't have to go chasing after their salesmen. They check up on deliveries to see that we get the material on the job when we need it and are always glad to help me in any way they can."

The boss doesn't say much but he walks off with a smile on his face. Whether you're the boss or the guy on the job, take a tip from me—

ASK YOUR ELECTRICAL DISTRIBUTOR— HE KNOWS—

It MUST Be Right

THE TRADE-MARK OF TOP QUALITY!

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

IT *MUST* BE RIGHT

"Glazon" Building Wire • "Glazon" Non-Metallic Sheathed Cable • Armored Cable • Service Entrance, Service Drop, Varnished Cambric Braided or Leaded, Trioprene Trench, Power and Parkway Cables • Bare Wire • Rigid Conduit Hot-Dipped Galvanized • Electric Metallic Thin Wall Conduit • Flexible Steel Conduit

"So Easy, even a girl can assemble it"

says Millie Seelhorst,
Pole Star Core Assembler

Miss Mildred Seelhorst, who works on the Pole Star Core Assembly Line, illustrates the ease with which the lapped core can be built into the coils of a Pennsylvania Pole Star Transformer.

The relative simplicity of this operation emphasizes an important feature of the Pole Star core:

In the event a coil is damaged by lightning or excessive overloading, the entire core and coil unit does not have to be scrapped — most of it can be used again, because the core can be taken apart and quickly rebuilt with replacement coils *without appreciably affecting the low core loss or exciting current of the Pole Star.*

This functional design feature of the Pole Star Core assumes added significance during the present period of national emergency, when it is necessary to conserve copper and steel wherever possible.

Pole Star Transformers are available in sizes 3 KVA through 100 KVA, 2400 through 14,400 Volts.

Laminations from center of core are inserted into the coils, brought through, and individually lapped. No special tools are needed, and the annealed steel is not bent beyond its elastic limits.

Each individual lamination forms its own magnetic path — is actually a core itself. Since there are no gaps or butt joints in the core, no mechanical clamping device is required to hold the core together.

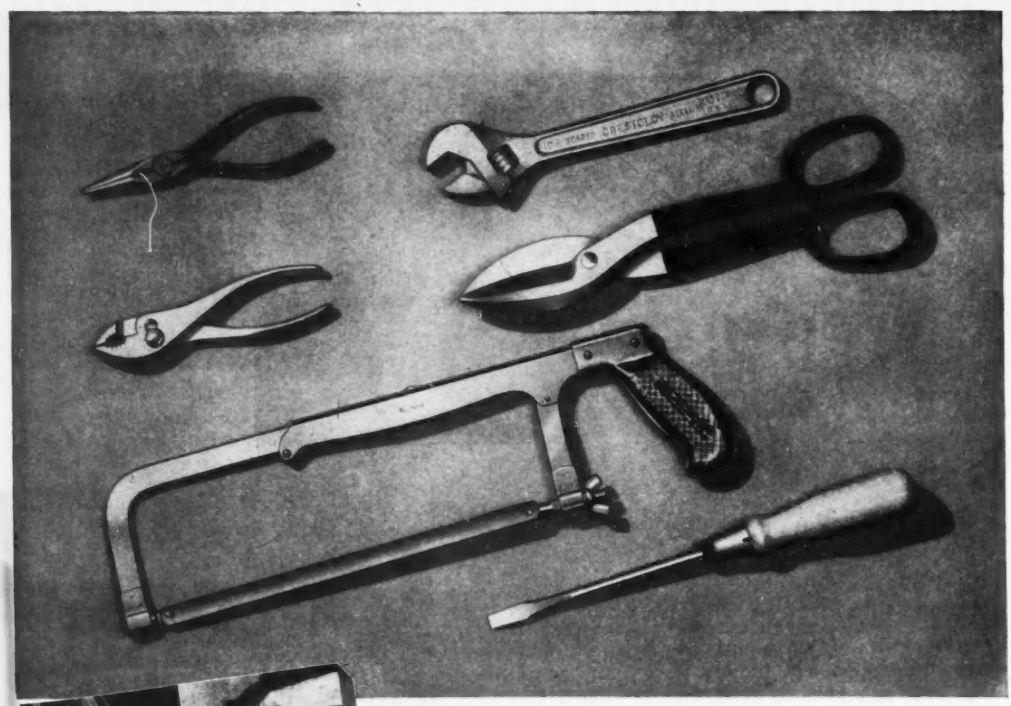
The last lamination is taped, then brazed, and the unit is complete. The amount of contact pressure between laminations is not important; therefore the noise level in the core will be at a low level and will not change.

P.S. Let the POLE STAR be your guide

Product Of Long Experience
Safe Thrifty And Reliable

Pennsylvania TRANSFORMER COMPANY

Canonsburg, Pennsylvania - Greater Pittsburgh District



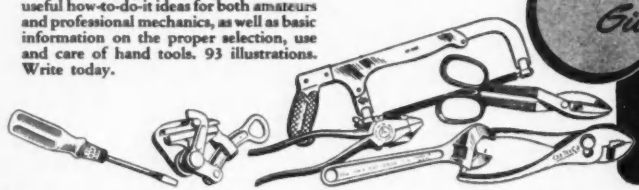
GOOD TOOLS

. . . save time . . . reduce costs

Users of Crescent and Crestoloy Tools have long since learned the economy of paying just a little more (than "cheap" tools cost) to get a whole lot more in hand tool quality. Superior tool design not only reduces worker fatigue but produces more and better output. The longer life of Crescent and Crestoloy Tools definitely reduces maintenance and replacement costs.

GET YOUR FREE COPY . . .

This new 20-page booklet provides many useful how-to-do-it ideas for both amateurs and professional mechanics, as well as basic information on the proper selection, use and care of hand tools. 93 illustrations. Write today.

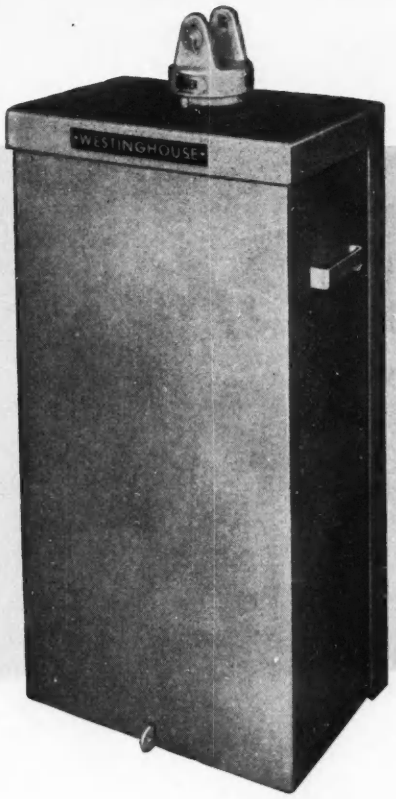


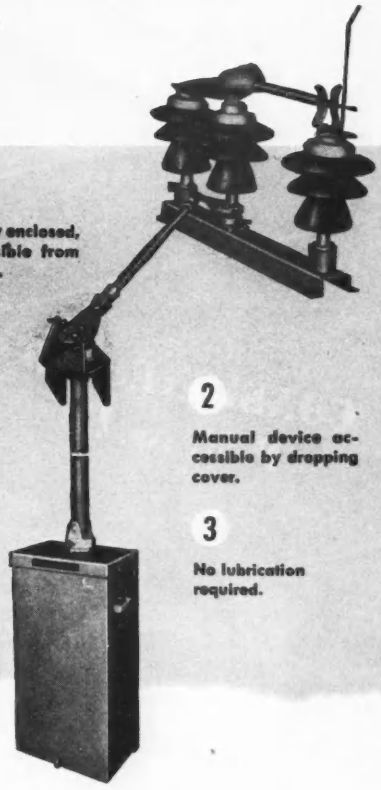
CRESCENT TOOLS
Give Wings to Work

Sign of the Artisan
Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK





1 Completely enclosed, yet accessible from either side.

2 Manual device accessible by dropping cover.

3 No lubrication required.

NOW... *AN IMPROVED MOTOR MECHANISM*

Matches Westinghouse Disconnecting Switch Performance!

Here's an electrical operating mechanism as modern in design as the Types V and RL Disconnecting Switches with which it is used. The T-3 Motor Mechanism incorporates the features your operators want—with fewer parts in a carefully designed assembly.

1. Manual operating device, weather-protected at all times—yet accessible by merely dropping cover to a self-supporting test position.
2. Complete three-side accessibility by removing only one cover.
3. Oilite bushings, plus sealed permanently lubricated ball bearings, eliminate the need for lubrication.

See "Electrical Proving Ground"... the dramatic story of the Westinghouse High Power Laboratory in sound and color motion picture. For details, see your Westinghouse representative or write Westinghouse, Film Division, Box 868, Pittsburgh 30, Pennsylvania.

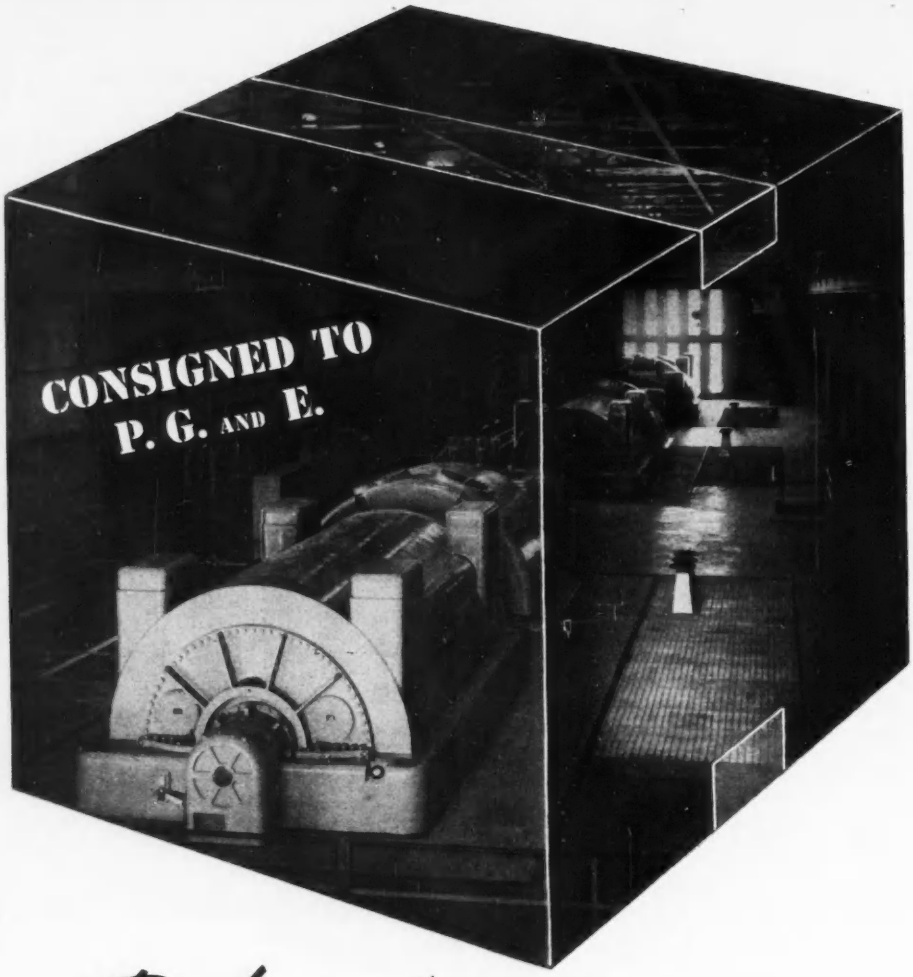
For complete information ask for bulletin C.S. 36-164. For information on the complete line of Westinghouse Disconnecting Switches, ask for booklet B-4726. Call your Westinghouse office or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60751

YOU CAN BE SURE... IF IT'S

Westinghouse

DISCONNECTING SWITCHES



Packaged and DELIVERED

ON THE LINE—300,000-kilowatts of Bechtel-designed-and-built generating capacity at the Contra Costa Steam Plant of Pacific Gas and Electric Company. Engineering and construction now under way will increase capacity to 500,000-kilowatts—this client's third major power plant by Bechtel in the last five years.

BECHTEL CORPORATION

"BUILDERS FOR INDUSTRY"

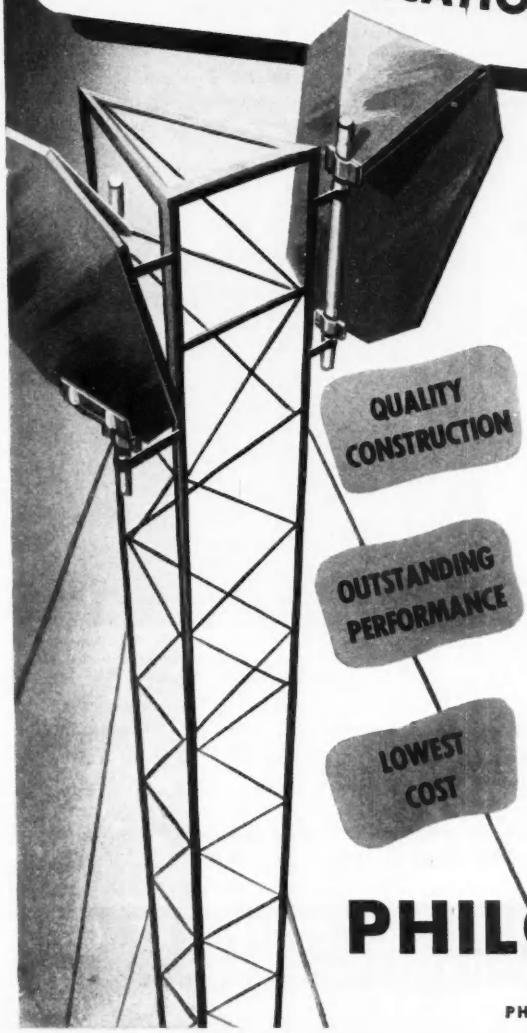
Los Angeles • **SAN FRANCISCO** • *New York*

BECHTEL

DON'T SETTLE FOR LESS!

PHILCO

Advanced Design MICROWAVE COMMUNICATIONS SYSTEMS



QUALITY CONSTRUCTION

OUTSTANDING PERFORMANCE

LOWEST COST

Again Philco leads the way . . . with Philco *Advanced Design* Microwave Communications Systems. Philco's years of experience in microwave development has produced a system unsurpassed in reliability, performance and economy.

All components are of the finest quality, conservatively rated, insuring long life and economical operation and maintenance.

A signal level 1000 times greater than normally required insures dependable service even under the most adverse conditions. Philco *Advanced Design* Microwave is flexible. The broadband microwave channel may be divided to carry up to 24 simultaneous 2-way telephone conversations . . . or be further divided for telegraph, teletype, telemetering, signaling or supervisory circuits.

Years of production experience enable Philco to produce microwave systems for the lowest possible cost consistent with highest quality. Future expansion can be easily accomplished with no loss of original investment.

For dependable communications service 24 hours a day, every day of the year . . . *don't settle for less* than Philco *Advanced Design* Microwave Communications Systems!

PHILCO CORPORATION

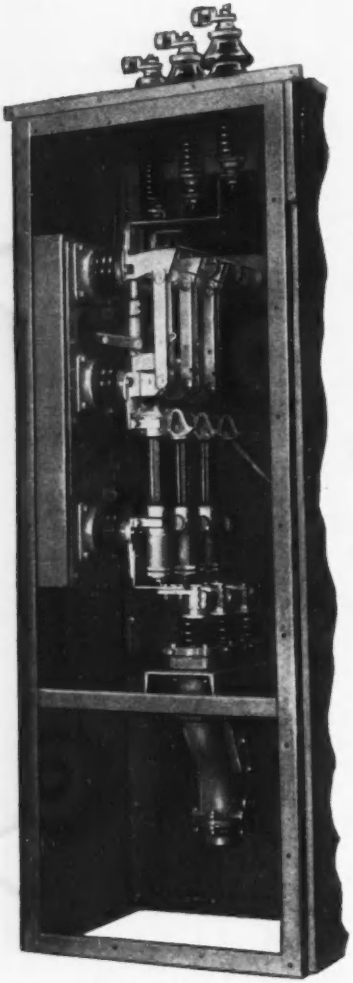
INDUSTRIAL DIVISION

PHILADELPHIA 34, PENNSYLVANIA

Buy FIRST CLASS Switchgear and SAVE MONEY TOO!

For substations, load and switching centers Three E switchgear is built to high standards of (1) Safety (2) Accessibility and in a style that permits of (3) Economy.

1. **Equipment is metal enclosed with all design features in accordance with best engineering and manufacturing practices. When requested positive interlocks with enclosure doors and associated equipment provide additional safety.**
2. **All component parts are readily accessible for inspection, adjustment and maintainance.**
3. **Because Three E Air Interrupter Switches are used for load switching, and power fuses for clearing short circuits, substantial savings in costs are possible, over other types of equipment.**



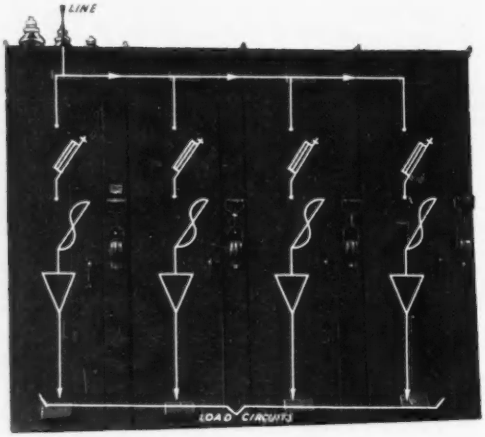
End view with side plate and barriers removed.

SYMBOLS

Air Interrupter Switch

Power Fuse

Cable End Bell

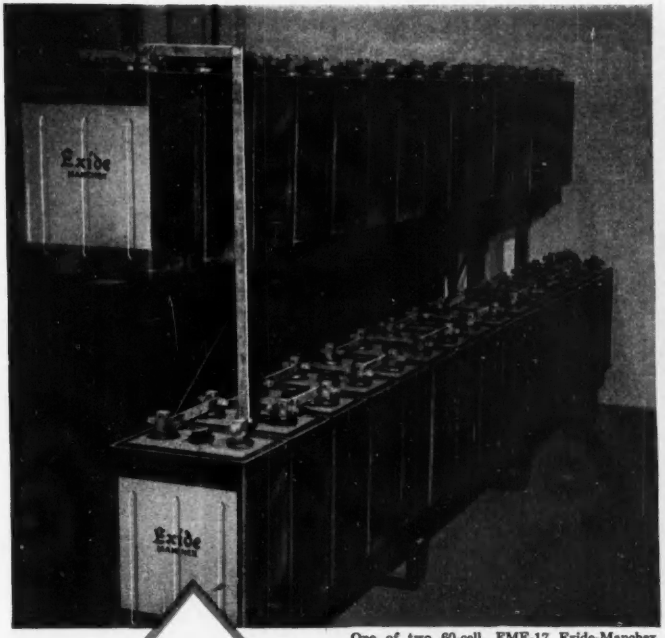


Front view of outdoor type four circuit switchgear assembly.

All Three E switchgear follows the modern trend of using self generated gas blasts which confine and extinguish arcs with no damage to equipment.

Consult your nearest Three E representative, or write us direct regarding your switchgear requirements.

THREE E — ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS



One of two 60-cell, FME-17 Exide-Manchex Batteries providing emergency power in the Edgemoor Station.

Delaware Power & Light Co., new Edgemoor Generation Station, Wilmington, Del. Built by United Engineers & Constructors Inc.

DEPENDABLE POWER FOR THE DIAMOND STATE

Exide-Manchex BATTERIES

In the Delaware Power & Light Company's new Edgemoor Generation Station, near Wilmington, there are ninety-five 2.5 k.v. electrically operated circuit breakers, eight 12 k.v. pneumatically operated breakers, and a 5 k.w. inverter which supplies a.c. power for clocks, recording meters, and other instruments. And, in case of power failure, all this equipment operates efficiently and dependably on one of the two 60-cell FME-17 Exide-Manchex Batteries. The other battery provides for 9500 watts of emergency lighting.

The choice of Exide-Manchex Batteries for emergency power is a logical one, for in Exide-Manchex you get . . .

POSITIVE OPERATION: Dependable performance at ample voltage with no switching failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for dependable performance of all other control circuits and also emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COST: Water required about twice a year. No change of chemical solution needed during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding of equipment.

These features all contribute to the dependable performance of Exide-Manchex Batteries—help make Exide-Manchex *your best battery buy* for all control and substation services.

• • •

LEAD CALCIUM BATTERIES

Exide first produced Lead Calcium Batteries in 1935. Since that time we have progressively followed an extensive program of laboratory research and development along with a study of Exide Lead Calcium Batteries in actual service.

Much has been learned during those 16 years. Though the time is too short to specifically predict length of battery life, definite conclusions have been reached regarding proper application. We will be glad to inform you where these cells can satisfactorily serve.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 2

Exide Batteries of Canada, Limited, Toronto

"Exide" and "Manchex" Reg. Trade-marks U.S. Pat. Off.

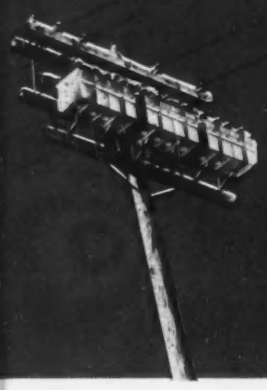
1888...DEPENDABLE BATTERIES FOR 63 YEARS...1951

LARGE SOUTHEASTERN SYSTEM

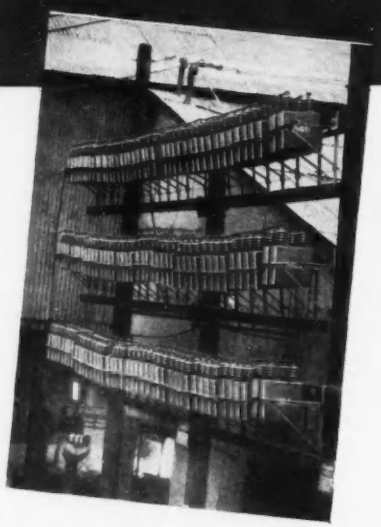
reports:

TROUBLE-FREE SERVICE

FROM ITS C-D CAPACITORS



Called upon to supply enormous quantities of power to vital government plants, this utility is extremely "power-factor conscious." To date, C-D capacitors have delivered over 500 million Kvar hours of trouble-free service for this utility, under the most severe operating conditions! This outstanding field performance record is typical of more than 4,000 C-D power-factor installations made in the past decade.



a real test for capacitor dependability!

C-D installation shown is at the Southern Ferro Alloys plant. The large open type furnace (in background) runs well over 3000° F. This, plus the summer sun, corrosive fumes, etc. is a most severe test of the capacitor installation's ruggedness.

A C-D engineer will be glad to point out the many dollar-saving characteristics of C-D capacitors. CORNELL-DUBILIER ELECTRIC CORP. DEPARTMENT **D 101** SOUTH PLAINFIELD, N. J.

CONSISTENTLY DEPENDABLE

CORNELL-DUBILIER CAPACITORS

PLANTS IN: SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER, CAMBRIDGE, MASS.; PROVIDENCE, R. I.; INDIANAPOLIS, IND.; FUQUAY SPRINGS, N. C. AND SUBSIDIARY: THE RADIART CORP., CLEVELAND, OHIO

WHEREVER YOU USE WOOD..

IN SALT WATER, marine wood-borers give a preservative its severest test. Of hundreds of preservatives that have been tried through the years, BARRETT* *Coal-Tar* Creosote is the only one that has proved consistently effective against teredos, limnoria and other salt-water enemies of wood.

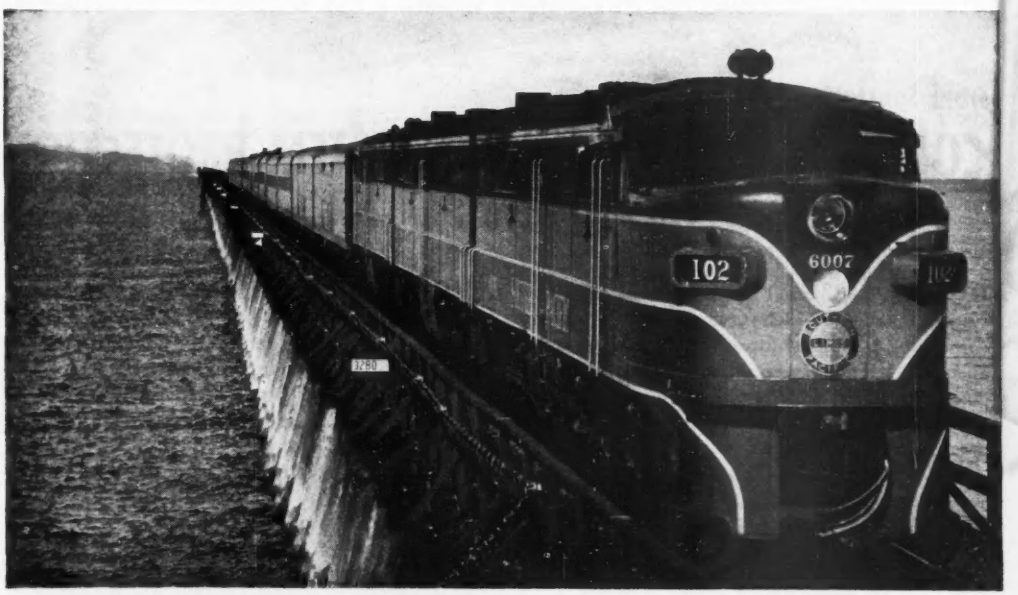
IN FRESH WATER, many preservatives leach out of wood. BARRETT Coal-Tar Creosote resists this leaching action. Being only negligibly soluble in water, it is the preferred preservative for use on submerged wood structures, or those exposed to the powerful action of rapidly flowing water.

IN THE SOUTH, prolonged high temperatures cause light-bodied preservatives to leach and evaporate from the wood, thus exposing the wood to termite attack and decay. BARRETT Coal-Tar Creosote, heavier bodied and of lower volatility, prevents this condition. It stays in the wood longer under all conditions—doesn't "run out" on the job.

IN THE SWAMPS, forces of decay are almost at their maximum of destructive power. High moisture content and infection from other decaying wood and debris are ever-present menaces. Poles properly treated with Coal-Tar Creosote have survived under swamp conditions for years.

IN THE DESERT, crossties broom, shatter and split from extreme dryness and heat. Solutions made with BARRETT Coal-Tar Creosote retard this, and also reduce mechanical wear of crossties through their lubricating action on the wood fibers. In poles, heavy treatment with BARRETT Coal-Tar Creosote substantially reduces checking and splitting.

IN THE NORTH, poles must resist the tremendous weight of frequent sleet storms. Avoid preservatives which *weaken* the wood. BARRETT Coal-Tar Creosote allows poles to retain their maximum strength, and helps to keep the poles at their best and hold the lines aloft.



THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Use Barrett* →

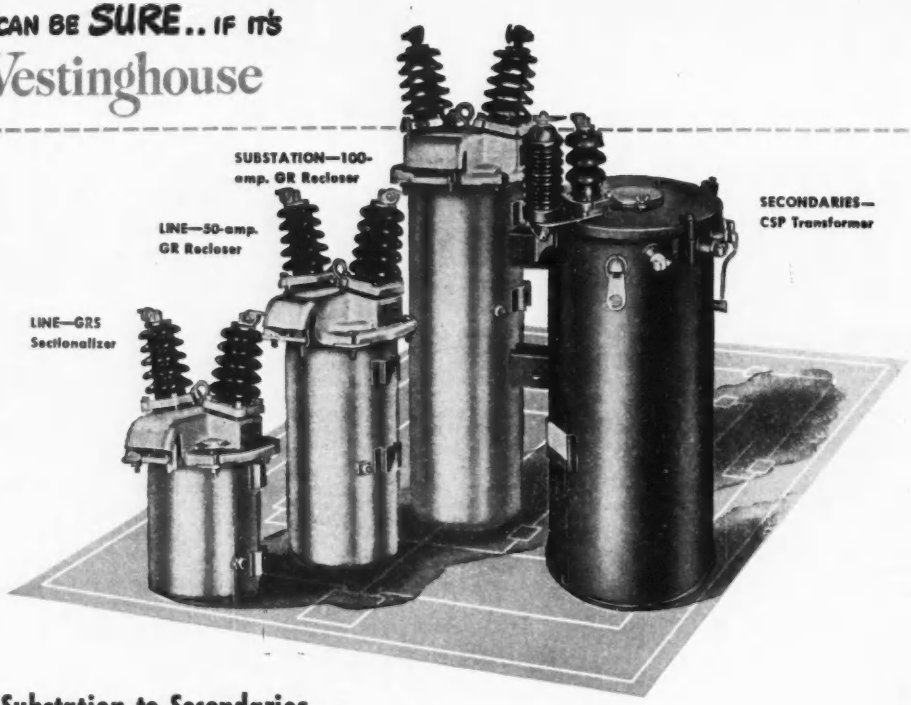
*Reg. U. S. Pat. Off.

Only coal-tar creosote wood preservative has been used long enough and widely enough to have proved its effectiveness under all conditions.

COAL TAR CREOSOTE

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



From Substation to Secondaries...

COMPLETELY MECHANICAL SYSTEM PROTECTION

...for lower, long-term distribution costs!

In this case, "mechanical" means a *fuseless* protective system... and one which promises many long-term, cost-saving advantages for rural and suburban lines. Specifically, it's a system which eliminates fuse replacement costs; which stays in proper co-ordination *permanently;* which simplifies the job of re-energizing faulted lines.

Its basic elements are those pictured above. The new Westinghouse GRS Sectionalizer, which is used in place of fuses, is its key component. Co-ordinated with substation reclosers, line reclosers and CSP Transformers, the sectionalizer permits—for the first time—attainment of a completely automatic, mechanical protective system... a *sure* way to gain this important objective:

The highest degree of service continuity at the lowest long-term cost!

The mechanical protective system is one of those analyzed in Booklet B-4700, which covers advantages, limitations and cost considerations of all types of protective schemes for rural and suburban lines. For your copy of this practical guide to better protection planning, write: Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa.

J-60738

Westinghouse

DISTRIBUTION APPARATUS

You won't run this ad...

when you mechanize with Remington Rand

PAYROLLS OUT IN HALF THE TIME

free folder AB-525

Time after time, users report such results; payrolls out twice as fast, with half the clerical cost. One line of writing gives you all four records: paycheck or envelope with correct net pay; statement of earnings and deductions; individual earnings record brought up-to-date; journal with all column totals (and extra copies for department payroll sheets).

UP-TO-MINUTE ACCOUNTS PAYABLE

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Here's a fast, flexible vouchering method for maximum income from discounts. It also gives you a daily analysis of purchases and expenses, any breakdown you need to show where money is being spent and why, *as a by-product of the voucher posting operation.* Checks can also be written on same machine for speed and control of payments.

Your present employees, already familiar with your procedures, can easily use this machine

Now you can get all the benefits of modern, mechanized accounting without upsetting your accounting personnel. No need to go outside to hire the specially-trained operators so scarce today. Here's what three users say:

Michigan: "We went around to other companies to examine their methods... the Remington Rand accounting machine seemed simpler than others."

California: "We installed the machine without a special operator... one of our employees was trained without difficulty."

Maryland: "The simply-designed keyboard and the complete visibility of the writing line are great aids to speed and production."

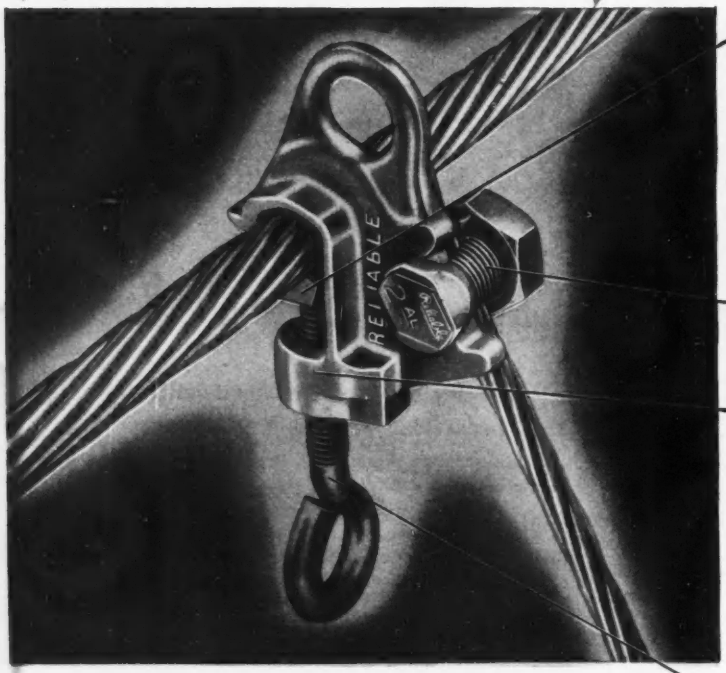
It's 100% electric! The operator simply enters amounts and descriptions on the *single* keyboard with standard alphabet keys, and only ten numeral keys for all figure work. The rest of the job is done automatically by the machine, giving you completed and proved records with up-to-date balances.

Ask your local representative for free folders, or write direct to Management Controls Reference Library, Room 1410, 315 Fourth Avenue, New York 10, N.Y.

EASIEST-TO-USE OF ALL THE ACCOUNTING MACHINES

call **Remington Rand** INC.

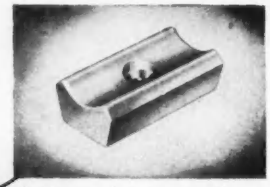
Accents on Accuracy



in the manufacture of

ALUMINUM HOT LINE CLAMPS

Manufactured of high-strength, heat-treated aluminum alloy, Reliable aluminum hot line clamps assure long, dependable service. Every step of manufacturing is closely controlled so that in use they work easily and smoothly with hot line tools. Where copper taps are used corrosion is minimized by a thick bi-metal copper-aluminum spacer in the tap connector. Galling and seizing are eliminated by threading the bronze eye screw through a bronze insert in the aluminum body. Reliable's accent on accuracy both in design and manufacture insures economy of operation through easier installation and longer life.



1. Pressure bar on end of eye-screw is a highly accurate, die formed, solid aluminum extrusion of generous area.

2. Sure and efficient tap connections are assured with the Reliable split bolt connector with its many elements of accurate manufacture.

3. Bronze insert is threaded into clamp body and rolled top and bottom. It is squarely tapped to provide highest percentage of thread engagement.

4. Silicon bronze eye screw has precision rolled threads and accurately centered rivet end for precision alignment with pressure bar.

Reliable ELECTRIC COMPANY

3145 CARROLL AVENUE, CHICAGO 12, ILLINOIS

OVER 40 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS
AND
CONSTRUCTION SPECIALTIES

Timely Facts and Features You'll Find in the NEOPRENE NOTEBOOK

- how you can reduce maintenance costs
- ways to solve many production problems
- new ideas on neoprene's wide range of uses
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FACTS ABOUT NEOPRENE FOR THE ENGINEER
PRODUCTS MADE OF NEOPRENE RESIST ATTACK BY MANY CHEMICALS
Products made of neoprene have been successfully used in contact
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FACTS ABOUT NEOPRENE FOR THE ENGINEER
LOW TEMPERATURE TESTING OF ELASTOMERS... PART 1
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YOU'LL FIND PROFITABLE READING in every issue of the Neoprene Notebook. Informative, up-to-the-minute articles on neoprene's properties, performance, and new neoprene products help you step up production efficiency and cut expenses. The feature articles in the two issues shown here are good examples of the authoritative reports that appear regularly. Pictures, graphs and charts make for easy, thorough understanding. Each issue is packed from cover to cover with new ideas to save you time, and money. Put your name on our mailing list. Subscriptions are FREE.

NEOPRENE

The rubber made by Du Pont since 1932

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REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

CLIP THIS COUPON AND MAIL IT TODAY

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Rubber Chemicals Division, G-10
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Please send me free issues of the Neoprene Notebook.

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Firm_____

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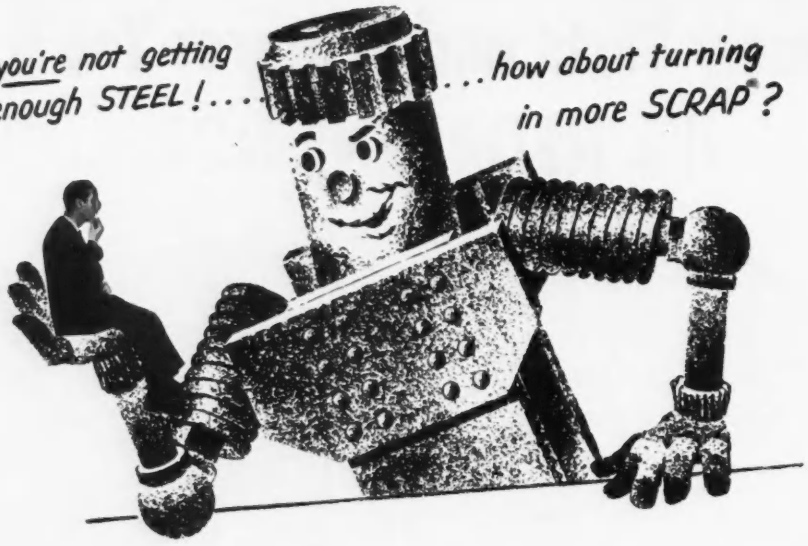

There's only one quick way to get more steel!

...get more SCRAP to the mills, at once

LET'S be realistic about the scrap shortage. The need for scrap is desperate. It theatens to hamper our whole National Defense effort—and it vitally concerns *you* because it boils down to this:

Unless 100,000 tons of industrial scrap roll into the steel mills every day, steel production will drop, and there'll be *less* steel for everyone—you included.

On the other hand, if more scrap is turned in, more steel will be turned out—and the more steel that's made the more steel *you'll* get.

So—if you want more steel—do your full share in getting your scrap back to the mills. Comb through your plant, again and again. Tap every source of dormant scrap. Dig out every retired machine that you can possibly spare and rush it to your scrap dealer. Rip out any old rails and switches that are rusting away on unused sidings—and scrap them. Scrap your antiquated dies, jigs and fixtures, your worn-out tanks and boilers that are gathering dust in some forgotten corner. Make sure that not a single pound of scrap is by-passed. Sell it—ship it. It means good money for you, more scrap for the Nation's scrap pile, and more steel for *everyone*.

• • •

Remember—the Nation's productive effort depends primarily on steel—and steel depends on SCRAP . . . *your* scrap. Turn it in—NOW.

You'll find your local scrap dealers listed in the yellow pages of the phone directory.

This page would ordinarily be used to tell you about

OUR STEEL WAREHOUSE SERVICE

but, because steel cannot be produced without SCRAP, we are asking instead for your all-out help in getting more SCRAP to the mills.

UNITED STATES STEEL SUPPLY COMPANY
WAREHOUSES COAST-TO-COAST

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USS

UNITED STATES STEEL

This Wide Acceptance is No Accident!

NETWORK TRANSFORMERS have to be tougher than most transformers. Not only are they subject to temperature extremes and overloads, but they have to withstand unusually severe operating conditions, flooding and corrosive atmospheres. Because they may have to operate in narrow, below-sidewalk vaults, maintenance is an important factor to consider.

That's why utility engineers are particular about the network transformers they choose for their systems.

One of the best testimonials to dependable all-around performance of Allis-Chalmers network transformers is the increasing approval of utilities and consulting firms throughout the country. Today the A-C label on major electrical systems is a familiar sight. Approximately 1¼ million kva of Allis-Chalmers network transformers are now serving the most important systems in the country.

This vote of confidence is based upon top performance. Details of welding, protective undercoating, convenient location of gages, sturdy core and coil construction and tank design make this outstanding performance possible.

Allis-Chalmers makes all three types of network transformers: oil-filled, *Chlorextol* liquid-filled and the new sealed dry type. Your Allis-Chalmers engineer can make unbiased recommendations on the best type for your particular requirements.

Why not call your local A-C office for more information. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 61B6152A. A-3515

Chlorextol is an Allis-Chalmers trademark.

LOOK

To Allis-Chalmers Network Transformers For:

- **Compactly designed** circular coil structure. Outside core clamping bolts, sturdy turn-to-turn insulation, built to withstand heavy short-circuit stresses. Thermal capacity is high for cool operation under severe load conditions.
- **Strong construction.** Main cover and switch compartment are welded to the tank to do away with gasket trouble.
- **Easy control** of tap changer operated through a two-inch outlet in the main cover. Eliminates packing gland maintenance.
- **Extra protection** of undercoating compound . . . plus sandblasting and three coats of baked-on phenolic base paint formulated to give high water resistance.

ALLIS-CHALMERS

Network Transformers—Over 1,000,000 KVA Installed

Have you ever seen a flying 'dust' man?

...Then ask a Buell Engineer to determine the most efficient, most economical method of collecting nuisance dust —for you

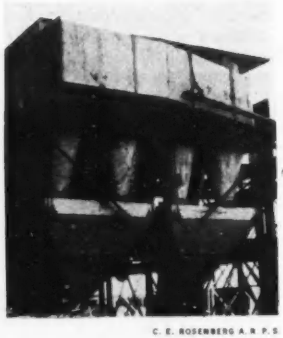
When we're called upon to solve a fly-ash problem, Buell engineers plan with precision, yet move with surprising speed.

Quickly they can pin-point your major cause of escaping dust...analyze the dust as to particular characteristics...Then, with a sureness that comes only by experience, they will recommend, design and build the Dust Collection System that will most efficiently and economically do the job.

The result? Employee morale goes up. Plant-community relations reach new and more favorable levels.

Buell engineers—a highly skilled group of industrial "dust" men—are backed by more than 200 man-years of experience in the science of dust collection. For full information write today. Ask for the new, informative Buell 'Dust Collection' bulletin. Buell Engineering Co., Dept. 60-J, 70 Pine Street, New York 5, N. Y.

Buell van Tongeren Cyclones take the guesswork out of efficient fly-ash collection.



C. E. ROSENBERG A. R. P. S.

ELECTRIC CYCLONIC

HIGH-EFFICIENCY CYCLONES • ELECTRIC PRECIPITATORS
TYPE "LR" COLLECTORS • LOW DRAFT LOSS COLLECTORS
SPECIAL PURPOSE COLLECTORS • DUST HOPPER VALVES

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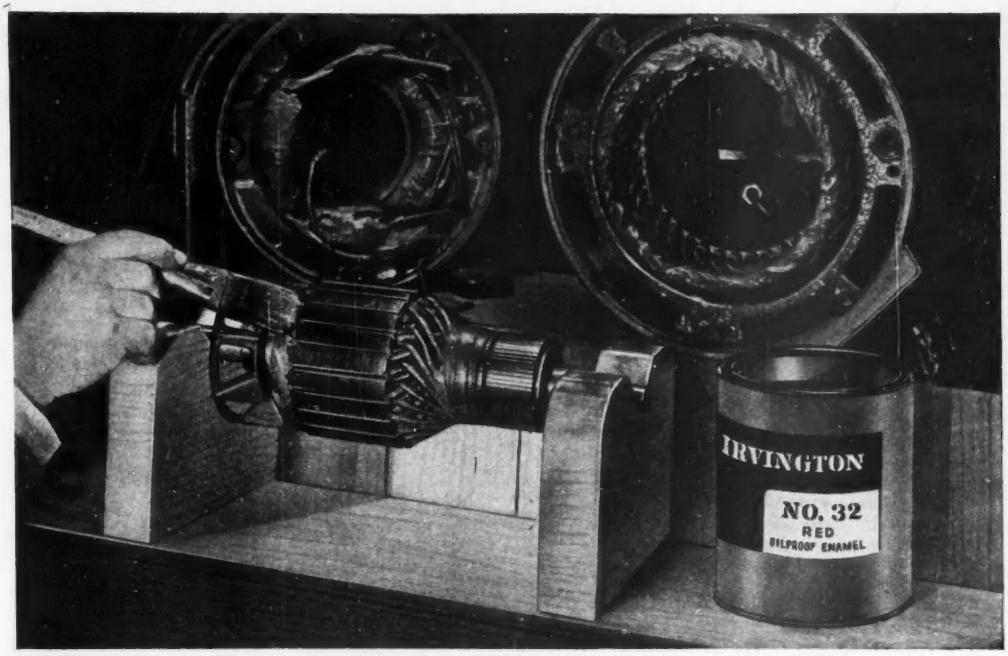
ENGINEERED EFFICIENCY IN DUST COLLECTION



Here's the LOW-COST way to HIGH oil resistance

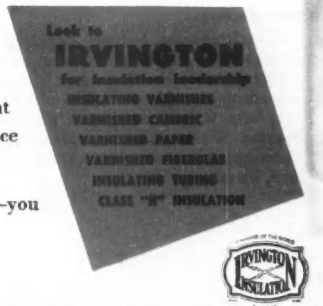
When insulation must have outstanding resistance to oil and grease, do the job the fast, inexpensive way—with Irvington No. 32 Red Enamel.

Irvington No. 32 Red costs less to *buy*—costs less to *use*. Just brush it on as the finish coat, over *any* type of insulation treatment. It is dry enough to handle in half an hour—completely dry in 8 hours.

With its dielectric strength of 800 volts per mil, the tough, adherent film gives a big plus in electrical protection—*along* with its resistance to oil, water, chemicals and abrasion.

Buy enough No. 32 Red at a time to be sure it's always on hand—you can store it without deterioration for long periods of time.

Send coupon today for free sample and technical data.



Send this convenient coupon now

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Plants: El Monte, California Hamilton, Ontario, Canada

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Irvington Varnish & Insulator Company
6C Argyle Terrace, Irvington 11, N. J.

☐ Please send me technical data on your No. 32 Red Enamel. ☐ I'd like a free sample for testing.

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....

You can profit

from Manchester's Experience

Quick, Easy Expansion with Westinghouse Network Transformers

Public Service Company of New Hampshire envisioned Manchester as a city sure to grow . . . power requirements certain to increase. That's why an underground secondary network system was installed . . . to give the flexibility needed to accommodate extensions, load shifts and future growth *economically.*

Already these predictions have come true. But the network system offered a simple solution. A number of new 500-kva Westinghouse Network Transformers were quickly and easily installed throughout the city.

Here's the transformer that offers greater savings in initial cost . . . and these *plus* features:

STANDARDIZED electrically and mechanically to meet industry requirements . . . to improve delivery and reduce costs.

CONTINUOUS WINDINGS with sliverless copper.

HIGH AND LOW-VOLTAGE COILS accurately centered to minimize short-circuit stresses.

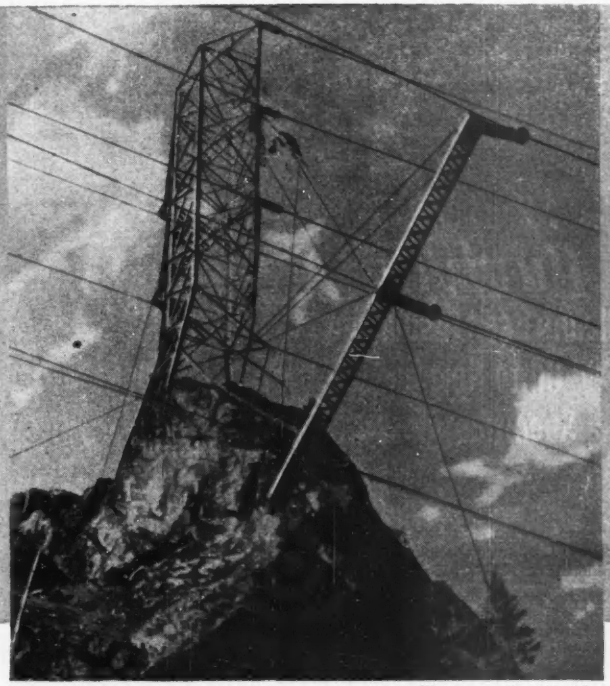
SINGLE RESPONSIBILITY—transformer, network protector, rotary switch all supplied by one manufacturer.

Westinghouse helped develop the network system over 29 years ago and has continuously pioneered new developments. Complete facilities including board analysis and competent engineers can help with your system planning. Call your nearest Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70614

YOU CAN BE SURE... IF IT'S

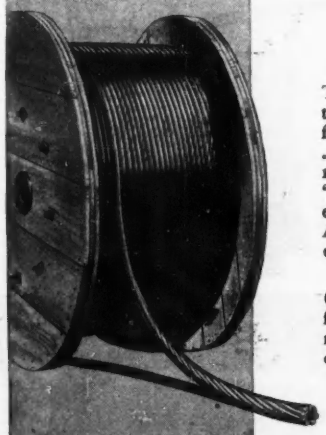
Westinghouse

NETWORK TRANSFORMERS



(Photo courtesy City of Seattle)

Another Way to Skin a Cat...



This spar arm carries 165-kv transmission line to make room for 230-kv line in rugged terrain ... both Alcoa ACSR. Where terrain is difficult, there are usually "several ways to skin a cat" and easy-to-handle, lightweight Alcoa ACSR often proves the easiest—and the best.

Alcoa made the first ACSR (Aluminum Cable Steel Reinforced) ... did the research that made mile-long spans possible, developed installation methods that made them practical.

Alcoa's storehouse of knowledge and 63 years' experience with aluminum and electricity is your assurance that you're dealing with those who can best help you solve your transmission line conductor problems.

Although the rearmament program prevents unrestricted use of aluminum, we are ready to help you with the planning required for power transmission projects.

TECHNICAL HELP—NO OBLIGATION

Write for help, advice or technical literature. Address: ALUMINUM COMPANY OF AMERICA, 2100K Gulf Bldg., Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM FIRST IN **A·C·S·R**

Aluminum Cable Steel Reinforced

here's more proof

Houdaille *Purivac* Cleans Used Insulating Oil to New Oil Specifications!

Utilities and power plants have proved that regular PURIVAC oil purification is sound preventive maintenance. PURIVAC purification prolongs the useful life of oil . . . keeps transformers and circuit breakers *clean* . . . prevents accumulation of contamination . . . reduces power failures and equipment damage caused by oil deterioration.

Records prove PURIVAC restores and maintains all desirable qualities of new insulating oil.

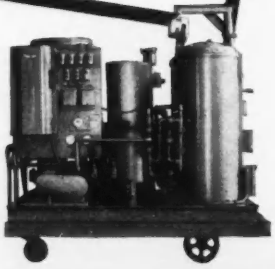
. . . and **only PURIVAC** gives you these added benefits:

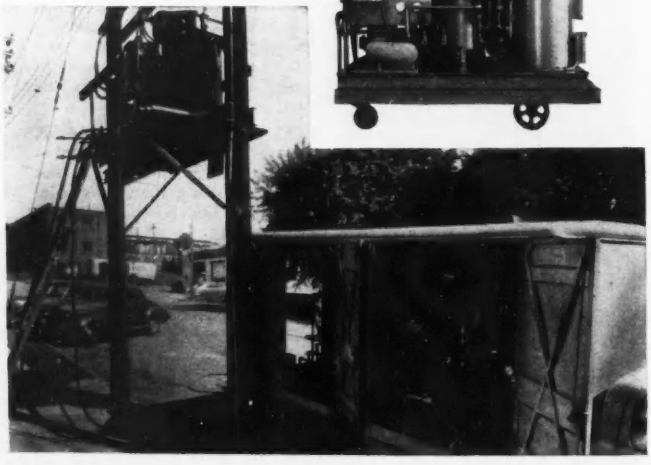
1. **PURIVAC performs complete purification, dehydration and degasification in *one operation*. No blotter press required. Operating cost is very small.**
2. **Performs equally well in the field or at a central station.**
3. **No service interruptions. PURIVAC purifies oil while transformers, circuit breakers, etc., are in operation.**

Results of Transformer Oil Purification Tests After PURIVAC Purification *

(Data supplied by Omaha Public Power District on eight transformers of 300 to 600 gallon cap.)

COLOR	IFT	NEUT. No.	DIELECTRIC
2	28.1	0.08	29.6
2	27.2	0.08	34.0
2	30.8	0.07	27.6
2	28.0	0.09	31.4
2	31.0	0.07	32.4
2	31.1	0.08	31.6
2	30.8	0.07	27.6
2	28.0	0.09	31.4





*Omaha Public Power District employs a Houdaille PURIVAC mounted in a truck to maintain a complete oil purification program covering *all* oil filled electrical equipment at the substation repair shop and more than 300 substations. More than 1200 pieces of equipment are served . . . some located 55 miles from the shop.

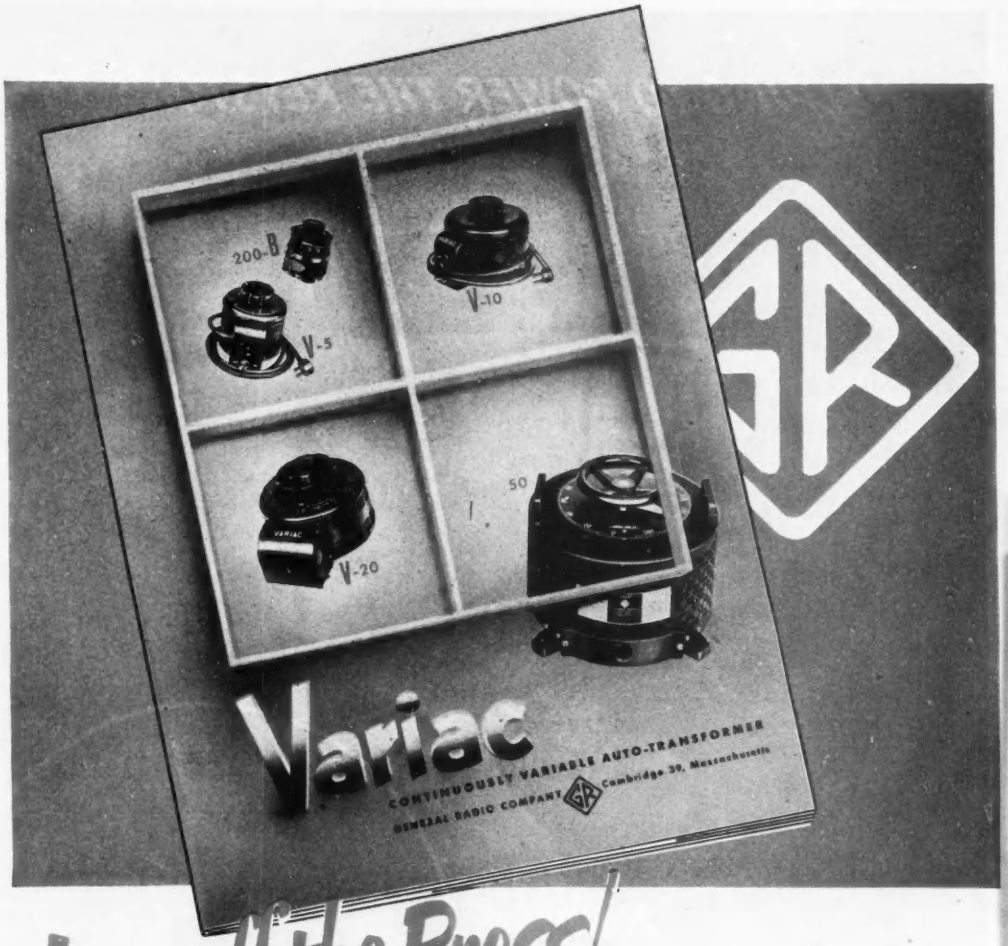
Officials credit PURIVAC with helping to maintain efficient, dependable electric power service in the Omaha area where heavy power demands require equipment to operate continuously under peak load conditions.

Write for complete information and specifications.

HONAN-CRANE CORPORATION
819 Wabash Ave.
Lebanon, Indiana

CL[illegible] OIL ENGINEERING

A Subsidiary of **HOUDAILLE-HERSHEY CORPORATION**



Just off the Press!

NEW Variac BULLETIN — Write for Your Copy

New models . . . more detailed electrical and mechanical specifications . . . complete table of all standard single, ganged and polyphase VARIACS are described in this profusely illustrated, complete VARIAC Bulletin, now ready for mailing. We know you'll want a copy. Fill in and mail the coupon below.

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SEND ME THE NEW VARIAC BULLETIN

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City _____ *Zone* ____ *State* _____

HELPING TO POWER THE KEYSTONE TO
BALDWIN-

SEATTLE'S GREAT HYDRO-ELECTRIC PROJECT

Baldwin Turbines

The 540-foot Ross Dam, fourth highest structure of its kind in the world, is the key structure in Seattle's Mammoth Skagit project that provides most of the municipality's electric power . . . and that also controls the disastrous floods that once swept the valley.

Three Baldwin turbines, each rated at 120,000 hp with runners designed for 355 feet effective head will be installed soon, adding 270,000 kw to the city's available power supply. A fourth unit is scheduled for installation later. When the height of the dam is raised an additional 125 feet, runners adapted to 440 feet will be installed, boosting the capacity of each unit to 140,000 hp. The view at left is typical of the 178 inch, 53 ton Baldwin Francis-type turbine runners that will be installed.

★ ★ ★

Baldwin has four valuable assets to offer to any group concerned with hydro-electric development.

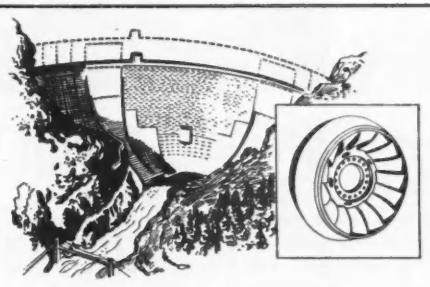
. . . A wealth of experience that covers every type of hydro project—plus a pioneering spirit that has repeatedly demonstrated that so-called "impossible" jobs *can be done.*

. . . A complete range of available capacities, that includes everything from small, fractional-horse power water wheels up to the largest units that can be shipped.

. . . A line that includes all four basic types of turbines—Impulse, Propeller, Francis, and Kaplan (adjustable blade). This permits unbiased selection of the type best suited to any head and flow condition.

. . . A complete line of valves, and other hydraulic machinery designed to function perfectly with the turbine units.

We will welcome an opportunity to discuss your project with you.



DESIGNED FOR FUTURE GROWTH

With an eye to the future, engineers designed the great Ross Dam for later growth. Ultimately, the height to the roadway will be raised to 665 feet, forming a lake 30 miles long with storage area of 3,450,000 acre-feet. Baldwin "know-how" will be utilized to design new turbine runners, no larger than the present ones, but adapted to the ultimate 440 feet effective head.

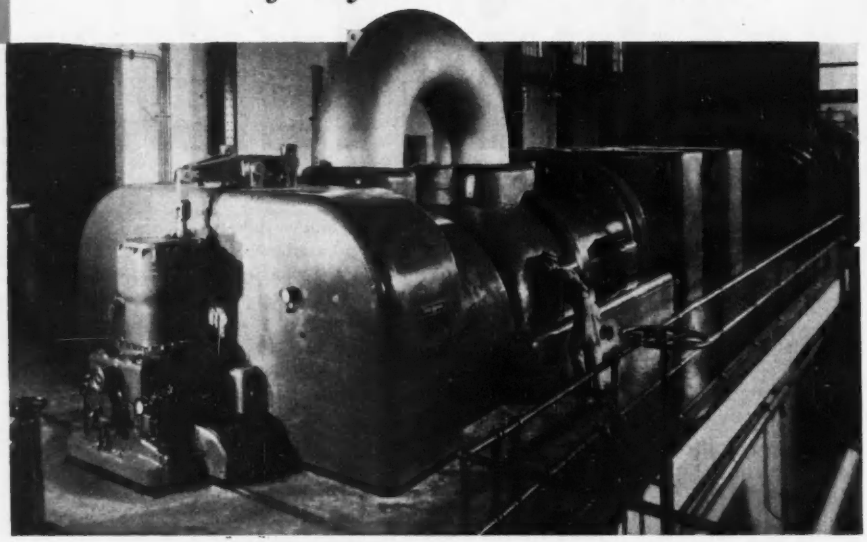
EDDYSTONE DIVISION
BALDWIN-LIMA-HAMILTON CORPORATION
Philadelphia 42, Pa.

PELTON WATER WHEEL COMPANY
2929 Nineteenth St., San Francisco 10, Calif.

BALDWIN BLH LIMA-HAMILTON

LIMA-HAMILTON

2 ways to insure a clean lubricating system for your new turbine . . .



FLUSH with Gulf Turbine Flushing Oil

FILL with Gulfcrest, the world's finest turbine oil

By taking these two steps, you can insure top lubricating efficiency down through the years for your new steam turbine.

The use of Gulf Turbine Flushing Oil—before the initial fill of lubricating oil—will remove grease-type slushing compounds and carry away harmful abrasives which might be in the circulating system. And, it protects all oil-bathed surfaces against rust. Because Gulf Turbine Flushing Oil is itself a satisfactory lubricant, the undrained portion does not impair the lubricating value of the turbine oil.

Then, to keep the new system clean, fill with Gulfcrest Oil. Because of its outstanding resistance to oxidation, Gulfcrest maintains an exceptionally low neutralization number, and lasts indefinitely. With this quality oil and good operating practice, you can be sure there will be no sludge deposits in cooler tubes, bearing pedestals, or oil lines to worry about.

To get these benefits for your new turbines, call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

GULF BUILDING, PITTSBURGH, PA.

FIFTY YEARS OF SERVICE 1901 GULF 1951

PETROLEUM AND ITS PRODUCTS

Watthour Meters Save Critical Copper

The house type watthour meter has long been recognized as the most accurate measuring device in common use. Today, the shortages of critical materials such as copper and steel, which now confront all industry, emphasize other important values of this device.

The watthour meter conserves kilowatt-hours by reducing wasteful use of electricity. It therefore helps to control kilowatt demand, which is directly related to the capacity of distribution, transmission and generation equipment. Hence, the watthour meter helps to conserve critical materials, all along the line, particularly copper. Following are the results of two interesting studies:

Quick facts on meter savings

Many studies have been made to determine the difference in the use of power between metered and unmetered loads. Take a typical study. Data were obtained on two housing projects, which had 623 families, to whom power was supplied in bulk; that is, at a flat rate, unmetered. Data were also obtained on two similar projects, with a total of 213 families, whose power was individually metered. Major finding: Unmetered service increased the demand on the system by the minimum of 0.1 kw per customer.

One kilowatt equals 150 pounds of copper

*Another study was made recently to determine the copper required to increase capacity for supplying residential loads. The copper included that required for power generation, transmission, and distribution—most of it being for overhead lines. Most important fact: about 150 pounds of copper are required to increase capacity by 1.0 kw.

Meters save many times their weight in copper

The findings of these studies may be summed up this way: Unmetered residential service increases the demand on the system—in one typical case by at least 0.1 kw per customer. That additional demand can be related to system copper all the way back to the generator—and could amount to as much as 15 pounds (0.1 x 150).

Allowing for varying system loadings and design characteristics, it is quite evident that on a broad basis, watthour meters save many times the amount of copper they require; not to mention the savings in magnetic steel, iron, and even fuel, required by the equipment "back of the meter." General Electric, Schenectady 5, N. Y.

**Copper Requirements for Power Systems*, ELECTRICAL WORLD, September 10, 1951. By H. E. Campbell and W. L. Kelly.

GENERAL ELECTRIC

601-80

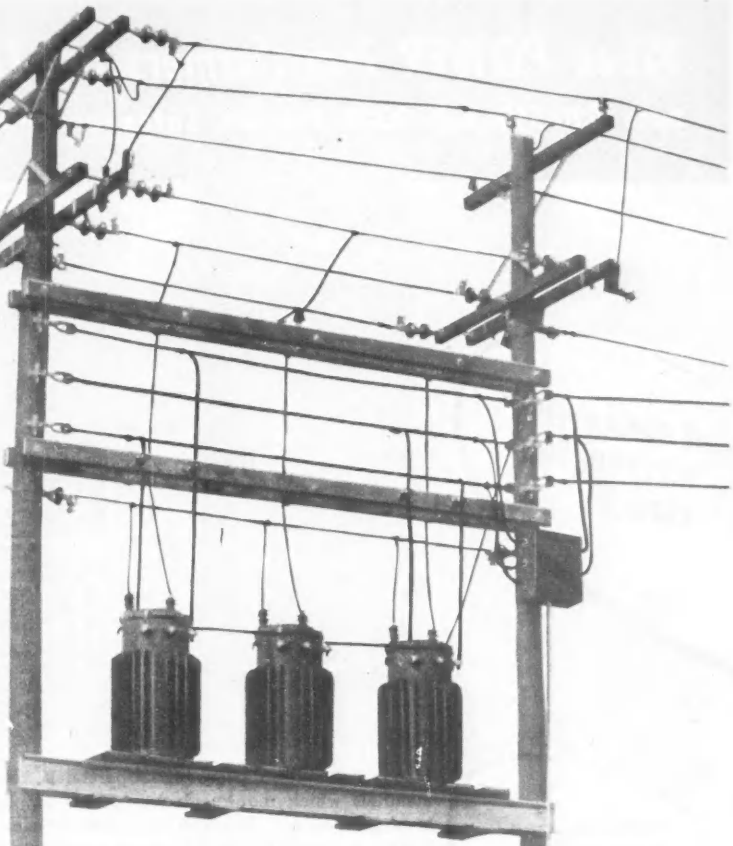
You can't top the score of Westinghouse fluorescent lamps for bright, long life

Outstanding performers . . . in offices and factories, in stores, in homes! You save on maintenance and you save on lamp replacement. Let these top-quality lamps save dollars and hours for you. Lamp Div., Westinghouse Elec. Corp., Bloomfield, N. J.

YOU CAN BE SURE...IF IT'S

Westinghouse

Monsanto PENTA protects transformer racks



Extra years of service have been added to the life of transformer racks installed by the Belfalls Electric Cooperative, Inc., of Rosebud, Texas, because the wood is protected by Monsanto Penta preservative.

"Penta was applied by brush," says Mr. Alvin L. Freeman, manager of the cooperative, "and we are well pleased with the treatment's penetration."

Monsanto Penta can be applied by brush, as well as by dip and pressure methods. Brush treatment makes it possible to protect structures already erected.

Properly formulated penta is a *clean* treatment. It protects poles and crossarms from decay due to fungi and from attack by termites and other wood-boring insects. Penta, a stable chemical, gives uniform, long-lasting protection. It is insoluble in water and does not leach. Penta treatment does not change dimensions of wood nor corrode common metals.

For technical data on the use of Monsanto Penta preservative, for sources of penta-protected lumber or for names of firms that will custom-treat your wood, contact the nearest Monsanto Sales Office or write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

Where To Use Penta Preservative

Poles and Crossarms • Planks covering underground cables • Transformer platforms • Sills and plates • Joists and girders • Screeds and subflooring • Flooring • Roof planks • Platforms and decking • Posts and fences • Cooling towers • Millwork • Guardrails • Truck beds • Construction timbers.

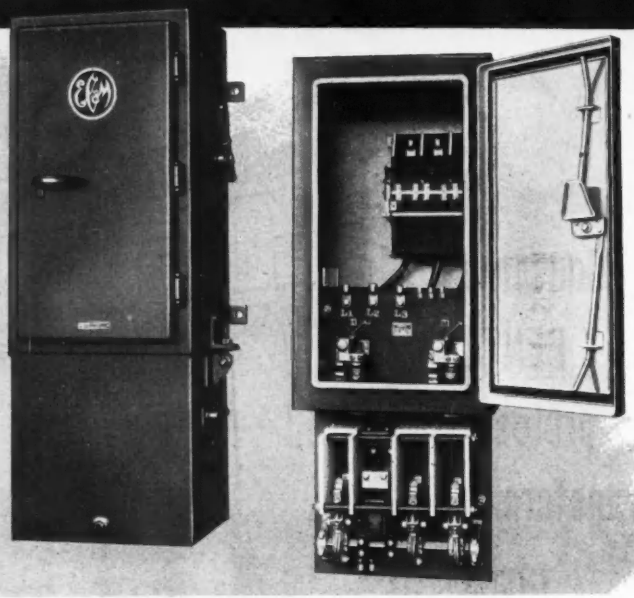
DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS — PLASTICS

Serving Industry... Which Serves Mankind

When POWER Transformers are LARGE---

these 220-550 volt EC&M Starters *Safeguard* Motor Investment



10,000-AMPERE INTERRUPTING CAPACITY

Weather-resistant enclosure * Drop oil tank * Instantaneous and inverse time-element trip on magnetic overload relays * Combination starter with self-contained disconnect

Many plants have processing operations for refining or reducing materials which require electric power supplied by transformers of large KVA rating. The fault capabilities of such a system can produce disastrous results to a standard low-voltage starter should a motor circuit be faulted.

For these low-voltage systems, the selection of motor starters is as important as those for higher voltages. Unless equipped with auxiliary protective devices, a standard starter with limited thermal and interrupting capacity is inadequate to protect the motor and starter circuit.

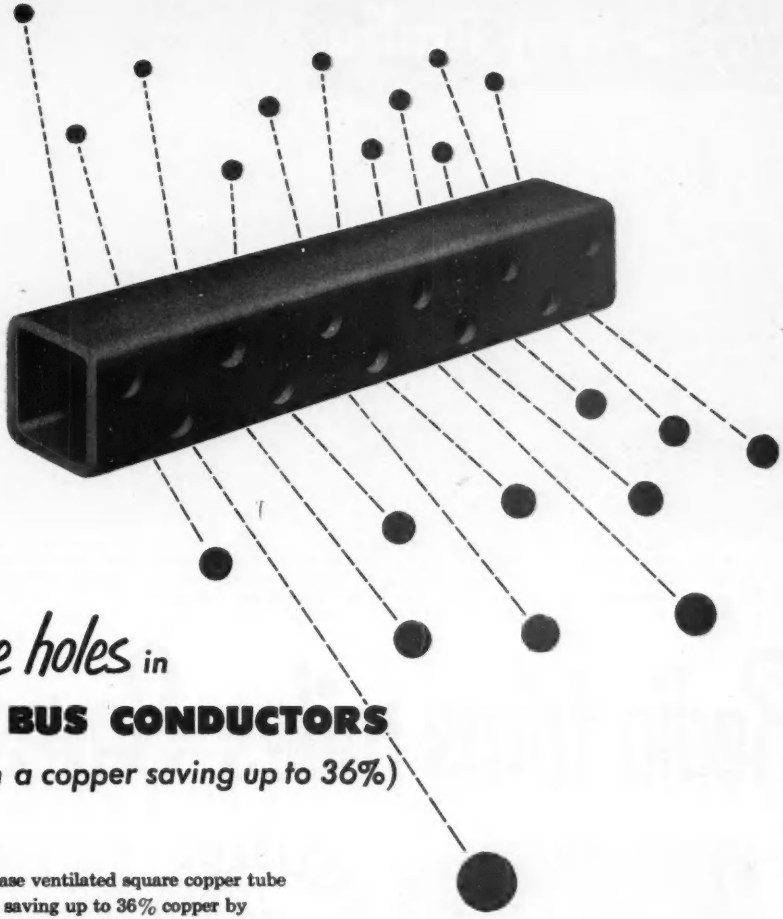
Especially developed for these applications are these EC&M Type LZ, Form HR, Leaflet 1069, Motor Starters which do not use auxiliary protective devices. Their thermal and interrupting rating is many times greater than that of a starter of standard construction. The 10,000-ampere interrupting capacity rating of these EC&M Starters has been proved by test.

When transformers are large, safeguard the investment of motor, starter and wiring with these EC&M, Leaflet 1069, Motor Starters. Contact your nearby EC&M Sales Office for complete information.

Write for Leaflet 1069

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79TH STREET • CLEVELAND 4, OHIO



Note the holes in

CHASE BUS CONDUCTORS

(they mean a copper saving up to 36%)

When you use Chase ventilated square copper tube conductors you're saving up to 36% copper by weight compared to using flat bars.

Chase square copper tube bus conductors have high thermal conductivity and low voltage drop and power loss per pound of metal. Ventilating holes aid in the dissipation of heat, increase the current-carrying capacity about 20% over unventilated tubes.

For full information about the characteristics of Chase square copper tube buses, fill out and send the coupon.

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

• *The Nation's Headquarters for Brass & Copper*

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
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Boston	Detroit	Minneapolis	Providence	(†Sales office only)
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CHASE 75th ANNIVERSARY 1876 1951

FREE Chase Bus Conductor Handbook gives physical and electrical characteristics and data on copper saving.

Chase Brass & Copper Co., Dept. EW 1051A
Waterbury 20, Conn.

Please send me the Chase Copper Bus Conductor Handbook.

Name_____

Position_____

Firm_____

Address_____

City_____ State_____

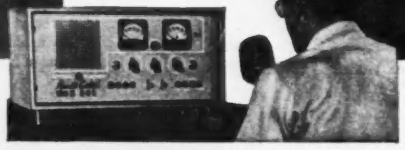
2-Way Radio

Underbuilding circuit on existing line in desert country. This service truck and crew are 30 miles northeast of Sierra's base station at Lovelock. Mobile receiver on truck is open continuously to pick up possible emergency calls to other parts of district. Battery drain is held at minimum by switching off transmitter filaments. Value of radio communication increases wherever topography or weather make land line maintenance difficult.

Radio trims miles-Saves hours-

Homes get quick service when trouble trucks are dispatched by radio. More calls per day with same gasoline consumption cuts fleet costs.

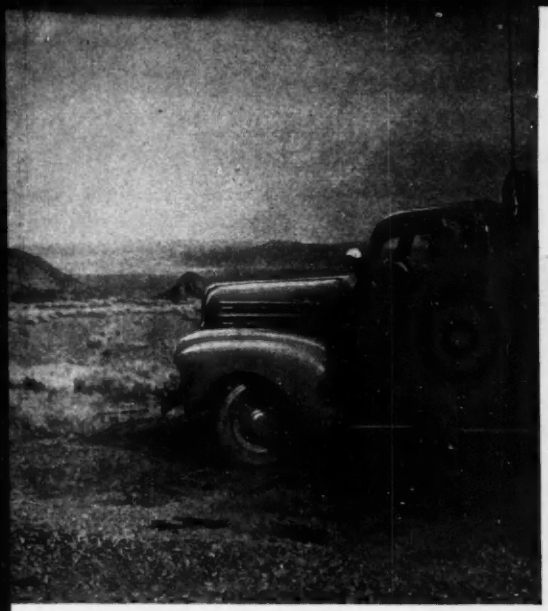
SIERRA PACIFIC POWER CO.



At Reno headquarters, service center director Lauritz Lund operates well-ordered communications system, controls 8 base stations and 50 mobile units in 15 counties.

▲ **Six rich valleys** of valuable farm and ranch land comprise Sierra's southern area. Ranch customers are pleased with prompt service typified by Bob Shannon (above) dispatching line trucks from Carson City.

Historic Donner Pass forms background behind division superintendent in radio car. Sierra's 3 most important transmission lines cross this pass and year-round communication is vital. Note 120 kv structure at right.



Extending 300 miles to the horizon, Sierra substations and subtransmission lines cover rough mountain-desert terrain. Base station at Lovelock is 100 miles from this truck, but General Electric FM beam rides above static, delivers clear signal.

Line fault repairs in Carson Valley are completed by crew summoned via radio. 60' antenna (left) beams signals to trucks as far away as 110 miles.

to serve rugged mountain area!

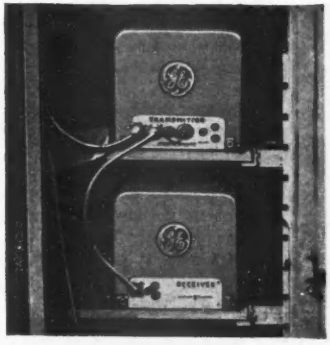
Sierra Pacific's mobile radio system ties together vast 15-county operation

To get more customer service per mile from its trucks and cars, this western utility makes profitable use of the latest in General Electric 2-way radio equipment. With eight base stations and 50 mobile units scattered over 15 counties, communication across rough terrain is no longer a problem.

Utility management knows the value of rapid servicing to hold customer satisfaction and cut line maintenance costs. Fast service demands fast communication, and G-E engineers are specialists at public service communication problems.

ASK YOUR G-E COMMUNICATIONS MAN

He has complete case history facts on what this equipment has done for other utilities. Why not let him show you how it can help your company? There's no obligation. Call the G-E office in your city or write us: *General Electric Company, Section 19101-22, Electronics Park, Syracuse, New York.*



Quality components are standard in G-E equipment. Mobile units shown are mounted in special compartment of service truck.

You can put your confidence in—

GENERAL ELECTRIC

BURNDY-BUILT *to do an important job* BETTER

BURNDY POWER CONNECTORS

Safeguarding the service continuity of your system is an important job and one that starts at the point of connection in the substation.

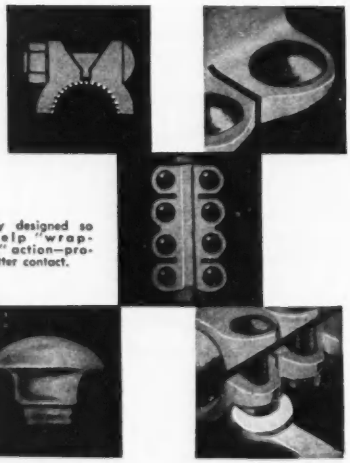
Burndy Power Connectors are engineered completely to meet all the requirements of substation service. The Burndy line is *complete*—over 140 standard types can be supplied for your connection needs on cable, tube, bar and special shapes—on copper and aluminum conductors.

Write for Catalog 50, or for prompt personal assistance ask for the Burndy Representative.

BURNDY
POWER CONNECTORS

Strong bolts, properly placed for high pressure contact.

Slots between bolts provide independent high pressure clamping areas.

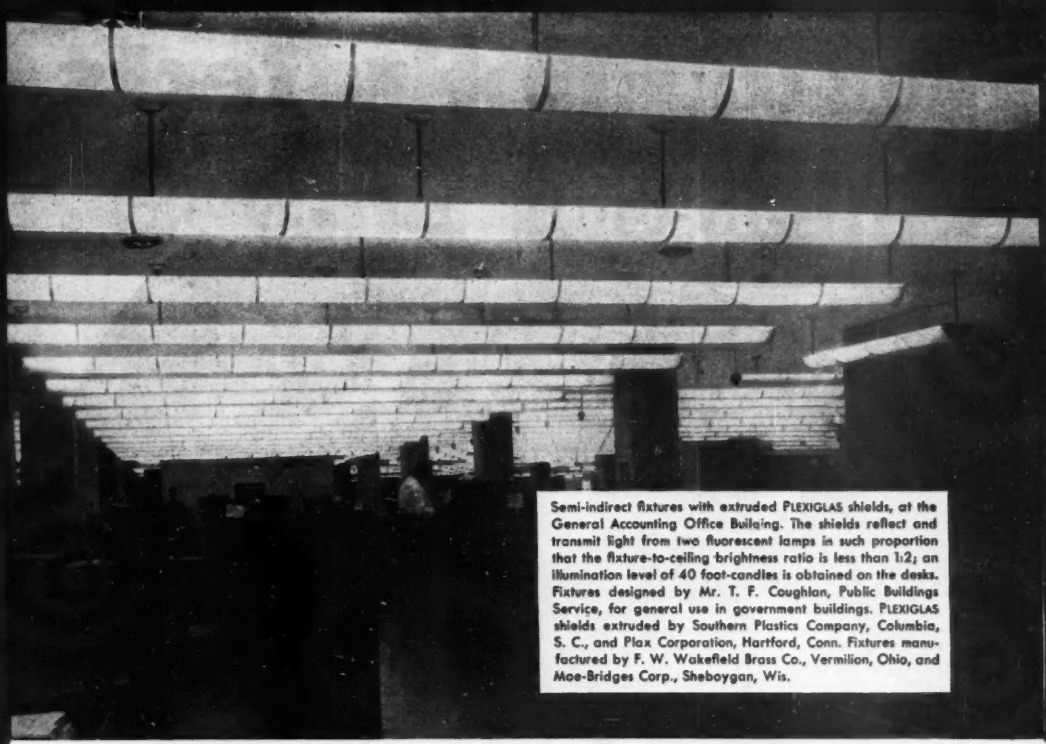


Specially designed so ribs help "wrap-around" action—provide better contact.

Bolts built to withstand stress—avoid stress corrosion, season-cracking.

Oval recesses in bolt lugs and oval-shank bolts permit easy, single-wrench installation.

Burndy, New York 54, N. Y. • *Western Branch: Vernon 58, Calif.* • *Burndy Canada Ltd., Toronto 8, Ontario*



Semi-indirect fixtures with extruded PLEXIGLAS shields, at the General Accounting Office Building. The shields reflect and transmit light from two fluorescent lamps in such proportion that the fixture-to-ceiling brightness ratio is less than 1:2; an illumination level of 40 foot-candles is obtained on the desks. Fixtures designed by Mr. T. F. Coughlan, Public Buildings Service, for general use in government buildings. PLEXIGLAS shields extruded by Southern Plastics Company, Columbia, S. C., and Plax Corporation, Hartford, Conn. Fixtures manufactured by F. W. Wakefield Brass Co., Vermilion, Ohio, and Moe-Bridges Corp., Sheboygan, Wis.

At the General Accounting Office Building . . .

Extruded PLEXIGLAS Shields

Nearly thirty-three thousand fluorescent fixtures, with twenty-five miles of translucent PLEXIGLAS shields, light the new General Accounting Office Building in Washington.

Extruded from PLEXIGLAS acrylic molding powder, the shields are important to the successful lighting of the building. They *reflect* light to the ceiling, to create large-area, low-brightness, indirect illumination. They also *transmit* the proper proportion of light needed to maintain a minimum brightness ratio between the luminaires and the ceiling.

From luminaires to luminous ceilings, white translucent PLEXIGLAS contributes to better lighting. Available in the form of flat or corrugated sheets, and as molded or extruded sections, this durable acrylic plastic provides uniform diffusion and efficient transmission of light—*plus* excellent color stability. In addition, the light weight and strength of PLEXIGLAS give freedom from breakage during installation and maintenance, and safety overhead in service. We will be glad to tell you how PLEXIGLAS can be used in your next lighting installation.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

Canadian Distributor: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.*

ALLIS-CHALMERS Switchgear Protects

IT TAKES electric power not only to operate finished telephones, but also to build them — for factory lighting, ventilation, cooling, and a multitude of processes and machines.

How Power is Distributed at Western Electric Plant

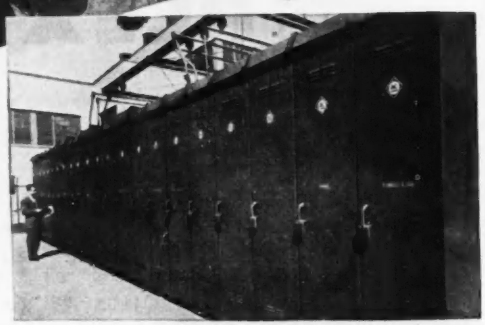
FLEXIBLE PRIMARY DISTRIBUTION

Electric power for the plant is obtained from a loop circuit supplying this industrial region, and feeds are taken from two power company substations to assure uninterrupted service. This precautionary duplication is continued in the primary distribution.

The 4160-volt outdoor switchgear itself consists of two main divisions. Each division is supplied by one feeder, and either can deliver power to any of the distribution lines. The two divisions are inter-connected by a bus-tie breaker.

ON-THE-SPOT SECONDARY DISTRIBUTION

The secondary distribution is accomplished with nine 500-kva lighting substations, eight 1000-kva power substations, and a 2000-kva boilerhouse substation. Six each of the power and lighting substations are paired together in six of the penthouses on the roof of the manufacturing building. These supply the main floor without utilizing valuable manufacturing floor space. Two more units are located on the lower floor of the building to supply that level with low voltage requirements. The remaining lighting substation is in the basement of the office building.



OUTDOOR SWITCHGEAR, adjacent to boilerhouse, feeds indoor substations and large high-voltage motors. Includes seventeen 1200-amp DZ-100B feeder oil circuit breakers and three 2000-amp DZ-100B main and bus-tie oil circuit breakers.

ALLIS-

FIRST IN THE U. S.

the Power Behind the Phone

AT Western Electric INDIANAPOLIS PLANT

SHUT-DOWN of the world's largest telephone-set manufacturing plant could cause a great loss in vitally needed production. To avoid such losses, Western Electric required a flexible but reliable power distribution and protection system for their giant new Shadeland Avenue plant at Indianapolis, Indiana.

To fill this requirement, Allis-Chalmers supplied a high-voltage primary-selective and low-voltage secondary-selective distribution system that is practically fool-proof. It would take the almost impossible simultaneous occurrence of four faults to throw this system out of order and cause a shut-down.

This Western Electric plant uses almost as much electric power as a community of 35,000 persons. The way this power is distributed is described on the facing page.

Adaptable to Your Needs

When you need power distribution equipment, it will pay you to follow Western Electric's example. Allis-Chalmers switchgear is standardized in basic design features for low initial and installation costs. But it is highly flexible in construction details and can therefore be built to suit every installation requirement.

Allis-Chalmers switchgear combines all elements for reliable circuit interruption with full safety to operating personnel. Safety features begin with a rugged, lap-welded, rigid steel enclosure with protective compartments. Interlocks and shutters provide positive safety to operators.

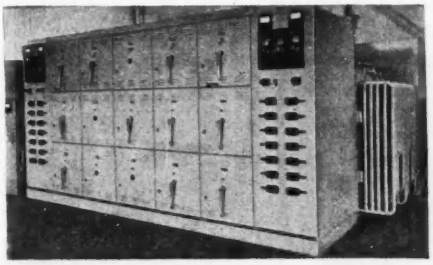
These same features plus many other details mean long, trouble-free operation. Attention to details is also characteristic of the circuit breakers themselves.

The G-50 low-voltage air circuit breakers used in the substations at the Western Electric Indianapolis plant have silver main contact tips and silver-tungsten arcing contact tips for good conductivity and low maintenance. Type DZ high-voltage oil circuit breakers are designed for low total arc energy to minimize oil and contact deterioration.

Information Available

Whether you need a complete new distribution system or a single breaker for increased capacity, your Allis-Chalmers representative can help you obtain maximum protection and reliability at minimum cost. Ask for general bulletin 18B6185A. It will provide you with a quick summary of the range and features available in Allis-Chalmers switchgear. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3455

Chlorextol is an Allis-Chalmers trademark.



DOUBLE-ENDED 2000-kva LCS unit substation in boilerhouse has 1600-amp G-50 main, 1200-amp G-50 bus-tie, 600-amp G-50 feeder air breakers. Chlorextol liquid filled transformers are 4160-480Y/277 volts, 1000 kva self-cooled, 1250 kva forced-air-cooled.

PENTHOUSE installation of 500-kva (left) and 1000-kva (right) LCS unit substations. Lighting unit has 4160-208/120-volt transformer, 1600-amp main and tie breakers, 225-amp feeder breakers. Power unit has 4160-480Y/277-volt transformer, 2000-amp main breakers, 1600-amp tie breaker, 600-amp feeder breakers.

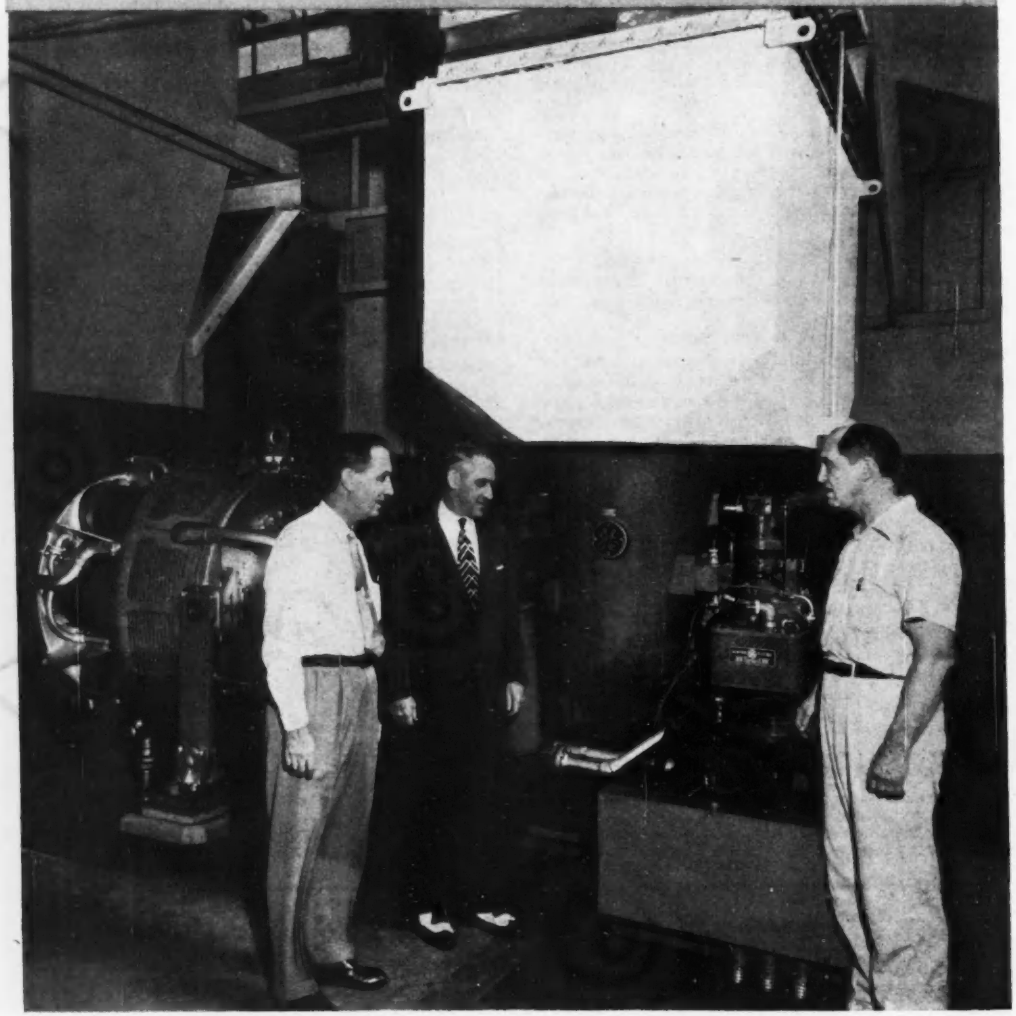
CHALMERS

WITH METAL-CLAD SWITCHGEAR

Combustion-Gas-Turbine

Total Installed Hours	17,604
Hours in Service	15,241
Total Power Produced in KWH	66,465,000
Average Load	4361 KW
Hours Scheduled Out	2326
Hours Forced Out	37
Unit Capacity Factor	124.6%

*A duplicate unit has just been ordered for installation in this station.



Donald S. Kennedy, President of Oklahoma Gas and Electric, inspects the 3500-kw combustion-gas-turbine at the Belle Isle Station with C. C. Willis (extreme left) Superintendent of Generation at O.G. & E. and G. D. Conley (extreme right), Chief Engineer at Belle Isle Station.

*completes 2 years at Belle Isle**

"Surpassed Expectations" says Donald S. Kennedy, President of Oklahoma Gas and Electric.

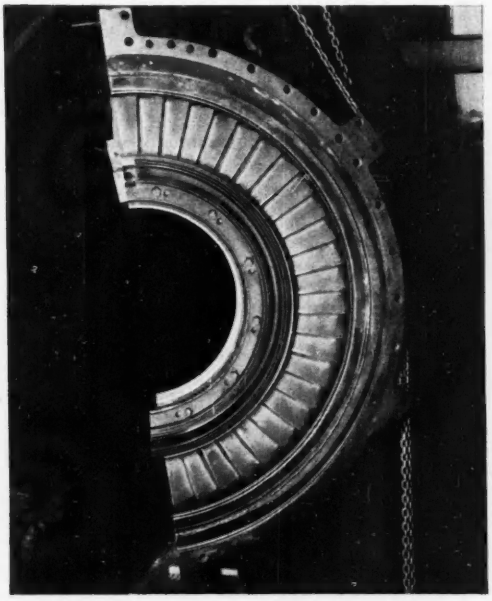
The first combustion-gas-turbine to be placed in commercial service in America has completed its second year of successful operation at the Belle Isle Station of the Oklahoma Gas and Electric Company. On the line since July 29, 1949, the 3500 kw unit has established a record which has surpassed contract commitments for both capacity and economy.

Donald S. Kennedy, President of the Oklahoma Gas and Electric Company, hailed the unit as eminently successful. "The combustion-gas-turbine at Belle Isle has been easily operated and maintained by our regular plant personnel. Maintenance costs have been lower and kilowatt output higher than we had anticipated. The output has averaged well over 100 per cent. Availability has been consistently high with only thirty-seven hours forced outage, due largely to the failure of a lube oil pump impeller. For availability, economy, and capacity, our gas-turbine has surpassed expectations."

General Electric combustion-gas-turbines are available in both 3500 kw and 5000 kw ratings. For complete details call your nearest G-E sales office or write for Bulletin GEA-5516, "Gas Turbine Power Plants." General Electric Company, Schenectady 5, New York.

11,823-HOUR INSPECTION REVEALS EXCELLENT OPERATING CONDITION

A routine semi-annual inspection of the Belle Isle gas turbine was held in March, 1951. This careful check-up on all original parts failed to uncover any major components —either rotating or combustion—which required replacement.



This half-section of the second-stage nozzle diaphragm had undergone almost no deterioration in twenty months of service. Its condition, typical of all diaphragm pieces, warranted no maintenance.

All six combustion chamber caps were reinstalled for further service. The discoloration around the gas fuel nozzle of this cap is a deposit of noncombustible residue from the fuel.

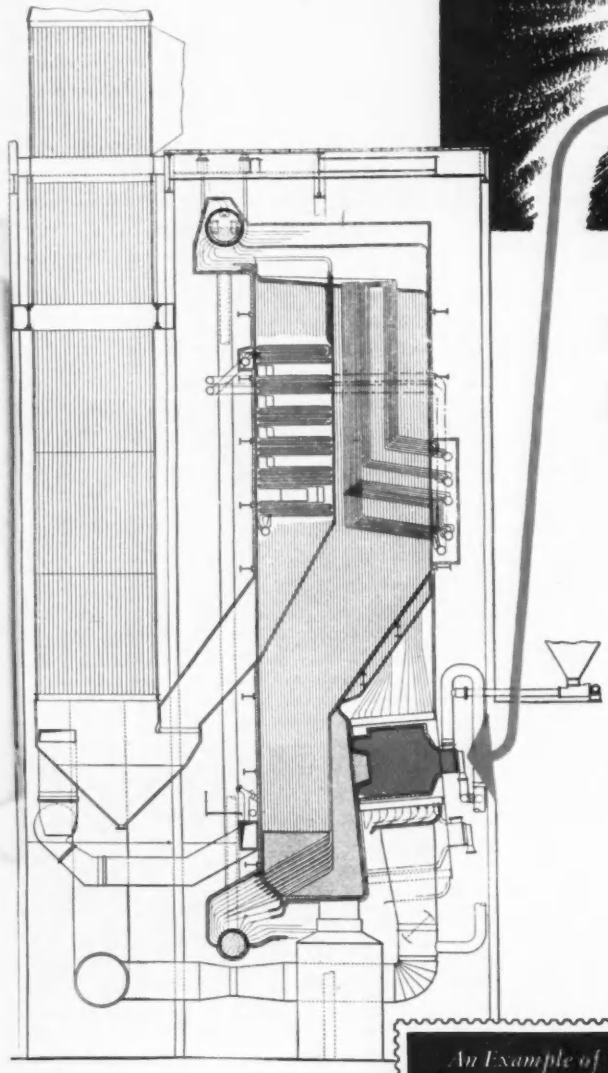
The compressor rotor, shown here with the top half of the casing removed, had collected a slight amount of dirt but was otherwise in original condition.

GENERAL ELECTRIC

255-5

Start here

with cost-saving B&W Cyclone-Furnace Boilers



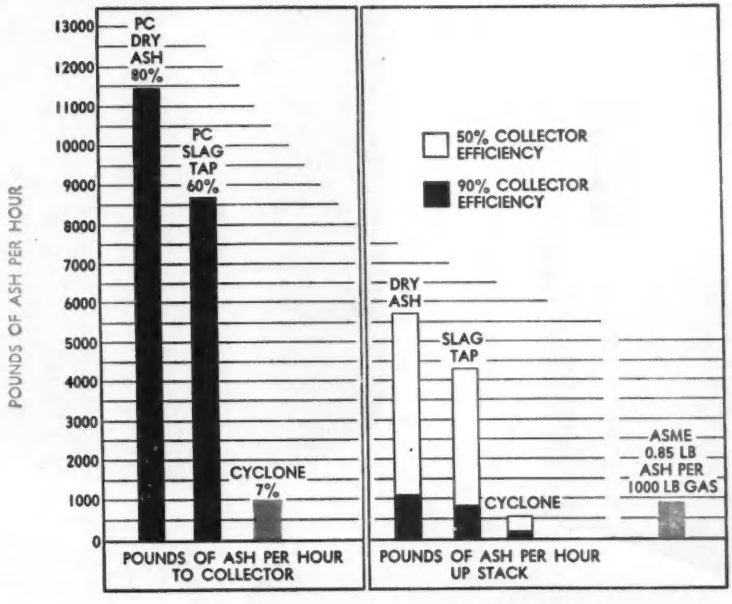
- **Savings**
  through simplification of collectors and ash-handling equipment, due to drastically reduced volume of fly-ash leaving the furnace.
- **Savings**
  through lower cost and maintenance of coal preparation equipment.
- **Savings**
  through higher boiler efficiency due to low excess air.
- **Savings**
  through reduction of boiler and building size.

An Example of B&W Engineering for Economy

for STACK DUST CONTROL

The logical place to *start* controlling fly-ash is *in the furnace,* where it is produced. B&W's unique Cyclone-Furnace recovers extremely high percentages of ash in the form of easy-to-handle slag. Your collectors handle only a small fraction of the dust-loading they would normally receive from pulverized-coal fired boilers, even those of the slag-tap furnace type. This big advantage, illustrated in a typical case study below, is only one of several that account for selection, since 1946, of Cyclone-Furnace Boilers with total steam capacity exceeding 14 million pounds per hour.

750,000 LB PER HR BOILER—16% ASH—10,000 BTU COAL—14,250 LB ASH PER HR

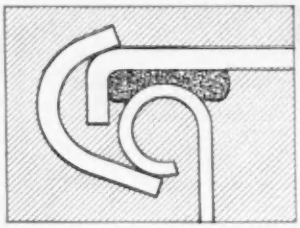


Helping Industry Cut Steam Costs Since 1867

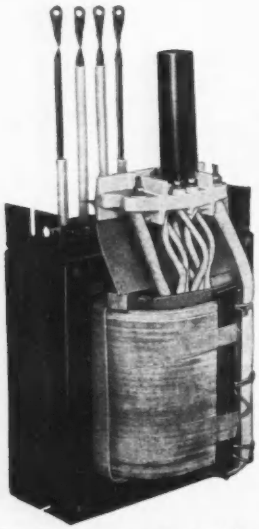
BABCOCK & WILCOX

G-514T

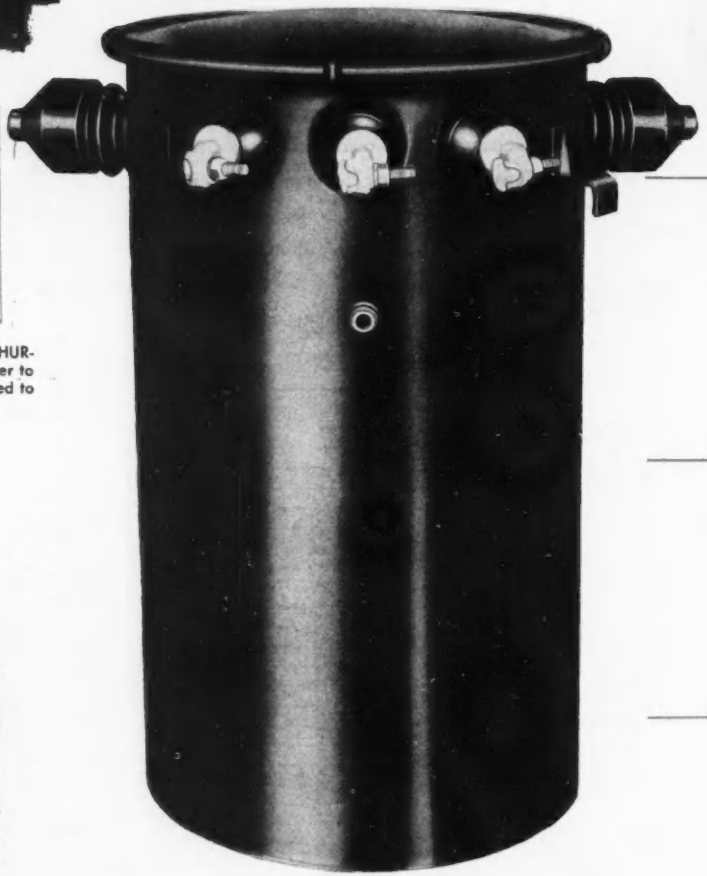
3 REASONS WHY—



Here's how the V-shaped cross section SHUR-SEAL Clamping Ring securely locks the cover to the tank. The Corprene gasket is compressed to assure an air-tight seal.



Form W cores are made of cold rolled, oriented grain steel, properly processed to obtain the lowest practical magnetic losses. The preformed core, assembled in rectangular shape, provides a path for the magnetic flux parallel to the grain of the steel.



Wagner Form W TRANSFORMERS

pay dividends in Extra Service

1 SHUR-SEAL COVER

An entirely new method of fastening the cover to the tank that provides true sealed tank construction. "Breathing" is prevented and no leakage of oil can occur during shipment or handling. The SHUR-SEAL Clamping Ring maintains equal pressure *all around* the cover —yet permits easy removal of the cover by loosening a *single* stainless steel bolt. Drainage channels prevent water from accumulating on the cover.

2 IMPROVED CORE AND COIL DESIGN

Form W elements, with preformed cores of cold rolled, oriented grain steel permit the construction of small size, light weight, yet liberally designed transformers. Form W Transformers are easy to store, to transport, and to mount on poles. They give excellent electrical performance—core and copper losses are low . . . short time overload capacity is high.

3 BUILT TO GIVE EXTRA VALUE

Wagner Form W Transformers are built the Wagner way—with the use of only the highest quality materials, carefully controlled production methods, and the skill acquired in sixty years of transformer building experience. That's why they pay dividends in longer service life.

WAGNER ELECTRIC CORPORATION

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INTERNATIONALS LEAD

Telephone equipment is more than heavy, it's very often delicate. To transport it easily and safely requires a truck that's not only a "bear" for strength and power, but a truck that's "careful of the load" as well.

No truck on the road meets these requirements as *economically* as an International. No wonder International Trucks are a top favorite with utilities men. Look at the advantages:

1. Every part of an International is heavy-duty engineered. This means amazing extra stamina, longer life, and above all—lower operating and maintenance costs to you regardless of the job.
2. The Comfo-Vision Cab, "roomiest on the road" means comfort-plus! You get controlled heat and ventilation, deep cushioned seats. And—there's full front visibility through that big, one-piece Sweepsight windshield. It's a driver's dream come true.
3. International Trucks have the best truck engines in the world, proved and perfected in the world's largest all-truck engine plant. No where else will you find such an efficient balance of power, speed, and maybe even more important to you, *economy*.
4. When you choose an International, you choose from the world's most complete line of trucks; 115 basic models, plus thousands of specialized variations. Gross Vehicle Weights run from 4,200 pounds all the way up to 90,000 pounds.
5. International Trucks are backed by the largest, most complete, and best equipped *exclusive* truck servicing system in the world. Specifically this means that you can always get expert servicing on your International, and you get it *fast!*

For a more complete story on the International that's *right* for your job, see your nearest International Truck Dealer or Branch soon.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors... Motor Trucks... Industrial Power... Refrigerators and Freezers

INTERNATIONAL HARVESTER COMPANY • CHICAGO

INTERNATIONAL TRUCKS

"Standard of the Highway"

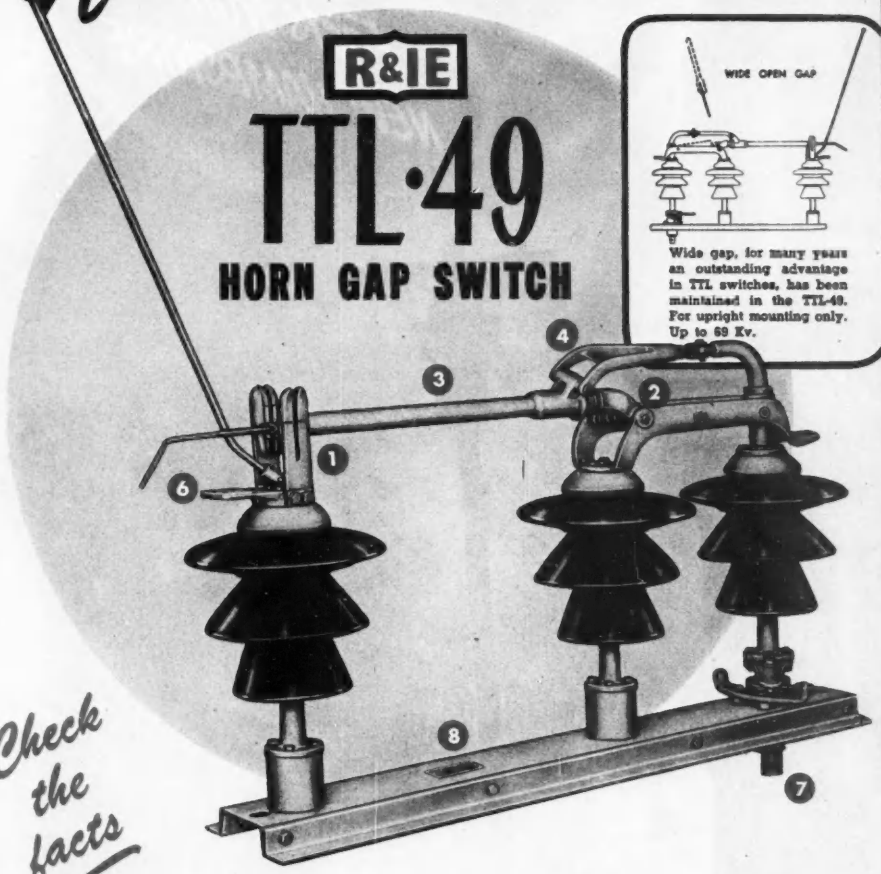
Now! IMPROVED OPERATING and SERVICE ADVANTAGES

R&IE

TTL·49

HORN GAP SWITCH

Wide gap, for many years an outstanding advantage in TTL switches, has been maintained in the TTL-49. For upright mounting only. Up to 69 Kv.

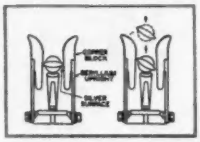


Check the facts

1. **Hi-Pressure Contacts.** Hi-Thermal capacity silver to copper contacts, beryllium and copper jaw. Beryllium for strength and resiliency, and copper for high conductivity.

2. **Hinge Contact.** Completely enclosed and weather sealed Hi-Pressure, Hi-Thermal capacity, silver to copper Hinge Contact. Continuous, constant electrical and mechanical contact. Eliminates second break contact with its multiplied problems.

3. **Contact released by blade rotation before blade starts opening operation.**



4. **Continuous Blade Operation.** Contact release and blade lift both are accomplished through smooth, uninterrupted blade operation with rotating insulator.

5. **All parts on live side of insulator are non-ferrous.**

6. **Terminals.** Both at same height from base. Clamping type with four half inch bolts at 1¾" centers. Universal, type UC clamps furnished.

7. **Greaseless, anti-friction, all-weather bearing supplied with stainless steel ball bearings.**

8. **Rigid, galvanized steel channel base.**

9. **NEMA Standard B.I.I. insulators.**

RAILWAY and INDUSTRIAL ENGINEERING CO., Greensburg, Pa.
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO
AN I-T-E SUBSIDIARY

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

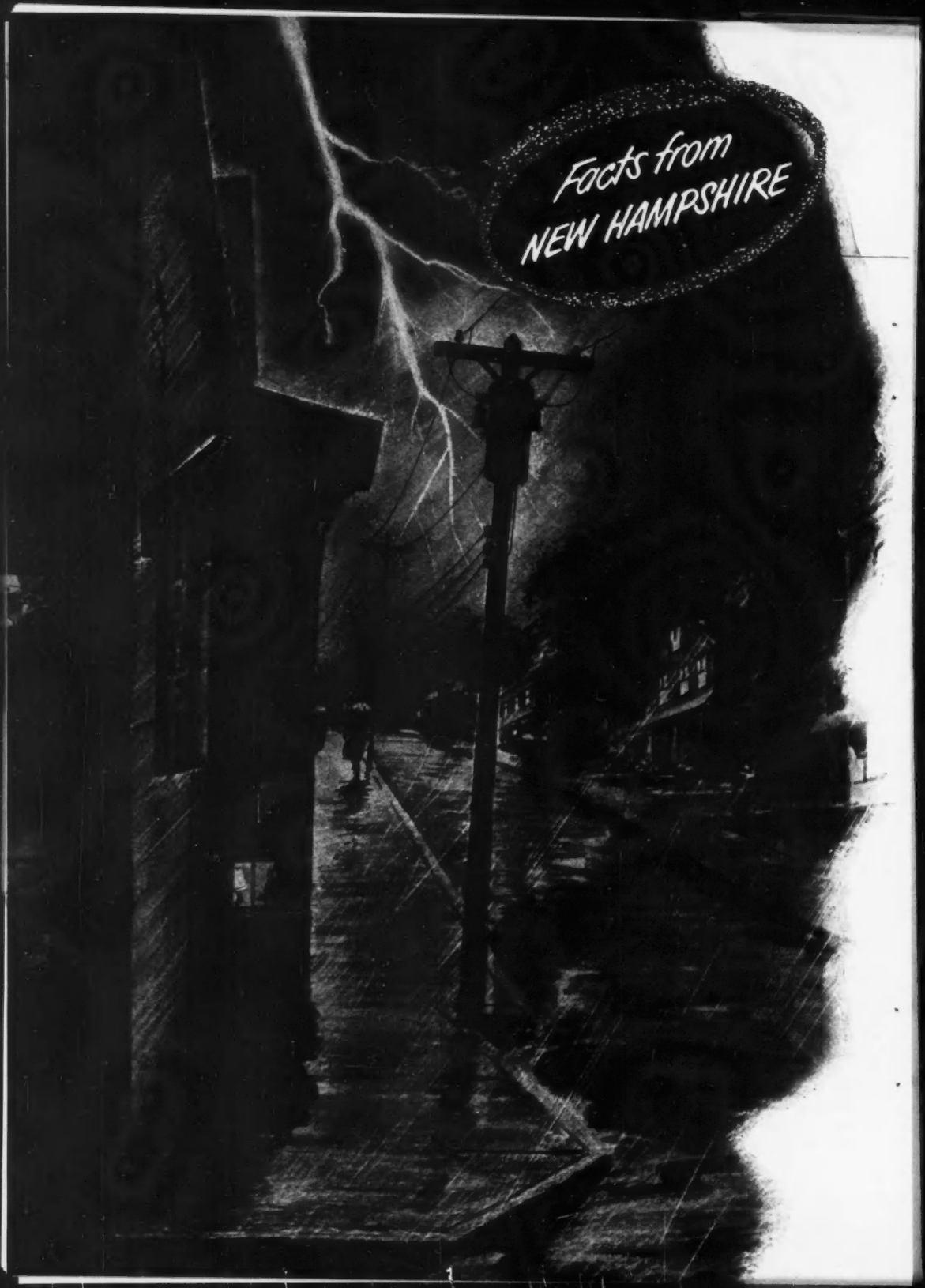
OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES


Facts from
NEW HAMPSHIRE

"8 Outages a month cut to zero with 'CSP' Transformer"

"Until three years ago, we were having considerable transformer trouble due to lightning. 'CSP' Transformers proved to be our solution," reports a New Hampshire Utility.

"One particularly troublesome 2,400-volt conventional transformer required re-fusing about twice a week during the lightning season. We tried interconnecting it, fused it for 10 amperes, and improved the ground with two extra No. 2 copper ground rods. Outages continued. One time the lightning arresters were actually blown up. We installed a 'CSP' Transformer, without any change in the existing ground, and no outages have been experienced since."

Installation and maintenance costs for "CSP" (Completely Self-Protecting) Transformers are always lower, because complete protective equipment is built in, not separately mounted. A two-year survey of Electric Light and Power Companies shows the following:

NATIONAL AVERAGES

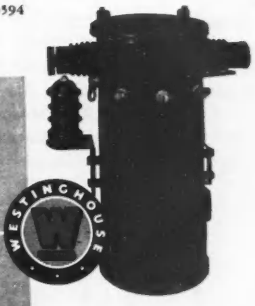
	"CSP"	Conventional
Installation Costs	$13.87	$24.74
Burn-out Rate	0.257%	1.005%
Fuse Outages	None	5.64% (at $6.52 per outage)
Load Checks	Automatic	12.8%
Breaker Reset	1.02%	None

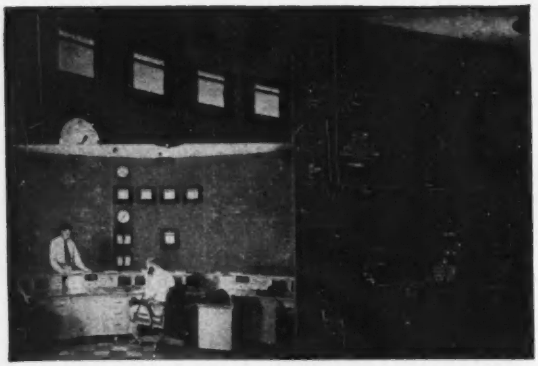
If you'd like to check your own costs against these national averages, ask your Westinghouse representative for Booklet B-4247-B, "Transformer Costs and Their Relation to Profits". Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70594

YOU CAN BE SURE... IF IT'S

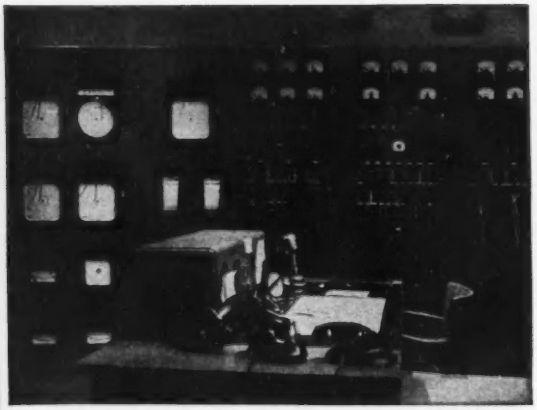
Westinghouse

"CSP" DISTRIBUTION TRANSFORMERS





METAMETER AT BONNEVILLE AND GRAND COULEE DAMS. Bristol strip-chart Metameters are used by the Bonneville Power Administration. The receivers shown above are installed on the Bonneville dispatcher's board at the H. D. Ross Substation, Ampere, Washington, and record Bonneville 230 KV, Bonneville total power, Coulee total power (transmitted from Grand Coulee Dam approximately 250 miles away), and system total power.



METAMETER AT ROCKLAND LIGHT AND POWER COMPANY, MIDDLETOWN, N. Y. The 15 Metameter indicating receivers at right show kilowatts, water levels and kilovars at three hydro-electric power plants. The three at left measure and record pressure of delivered gas, and integrate flow into the Company's distribution system at points up to 50 miles away. The other Bristol instruments totalize flow during a given period of time in the three supply lines and also give a continuous reading and a chart record of total instantaneous flow through all three lines.

DISPATCHING MADE EASIER

Bristol Metameter* telemeters give the dispatcher up-to-minute readings of electrical and other measurements made many miles away

A complete and continuous visual picture of what is happening at key points throughout the system enables the dispatcher to accurately appraise conditions instantly and act with full knowledge.

With information from his Metameter receivers, he can keep in touch with load changes and direct the generation and transmission of power more economically and with greater ease. He can foresee emergencies and take the necessary steps to maintain schedules. Often, he can increase safe maximum loads in tie lines considerably.

Among the types of information Bristol Metameter telemeters make available to the load dispatcher are: the load at each tie-line point, output of each generating station, totalized output (on one instrument) of all generating stations, active and reactive power and power demand at key points, voltage and current at various points.

Generating stations use Metameter for information on output of each associated station (attended or unattended), total output, water level and water wheel gate position, water level in reservoirs, surge tanks, etc.

Readings can be transmitted any distance, over any two-wire circuit or its equivalent, carrier-channel, telephone, telegraph or radio (including microwave) . . . to recording receivers (narrow or wide-strip chart or round chart) or indicating receivers.

Metameter is the tried-and-proved telemetering system. Thousands are in use on all types of service. Write us for Bulletin M1700. THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 20, Conn.

Reg. U. S. Pat. Off.

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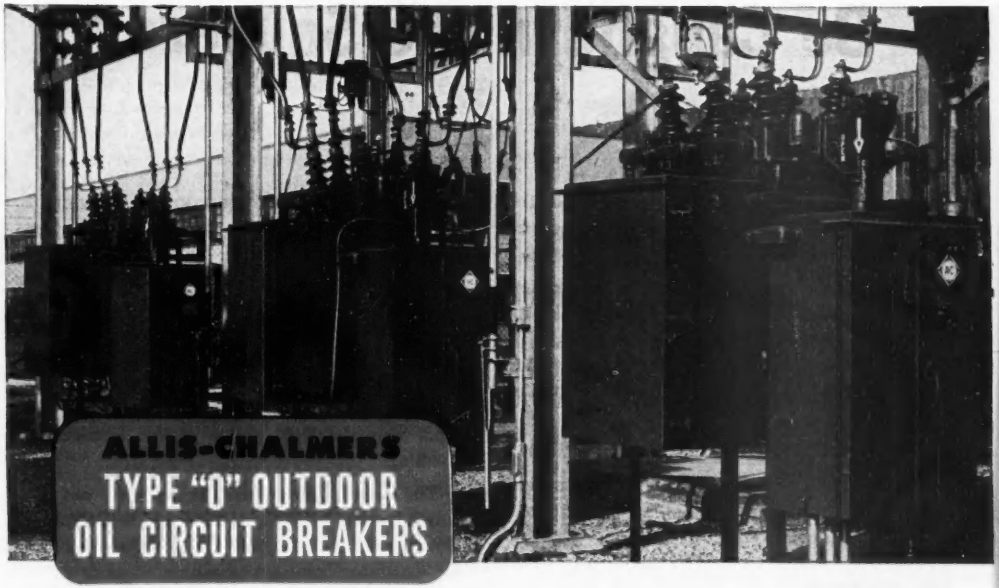
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Dependable

ELECTRICAL PROTECTION

FOR DISTRIBUTION SYSTEMS



Packaged complete for improved automatic reclosing service

ALL YOU NEED to order your type "O" breaker is one set of specifications. It's simple and convenient. This standard 3-pole breaker comes to you mounted on a strong lightweight framework with operating mechanism and automatic reclosing equipment each in its own weatherproof housing. The type "O" breaker is factory assembled, wired and tested in accordance with ASA standards . . . ready to install and operate.

SECURE THESE PROVEN ADVANTAGES

1 **Positive, high speed breaker action with mechanically and electrically trip-free solenoid operating mechanism, ac or dc operation as specified.**

2 **Efficient circuit interruption with high rate of dielectric recovery for low contact and oil deterioration.**

3 **Automatic reclosing duty for unattended stations with standard protective and reclosing relay equipment included.**

Feature for feature you cannot buy better breakers in this class. Over 50 years of Allis-Chalmers progress in power circuit breakers is built into them. You can install them with complete confidence. For more information call your local A-C sales office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for bulletins 71B6165A (OX-18) or 71B6093C (OZ-110, OZ-210).

A-3440

Type	Rated KV	Rated Amps. (60 cycle)	Interrupting Capacity KVA
OX-18	7.2	600	50,000
OZ-110	14.4	600	100,000
OZ-210	14.4	600	250,000
OZ-210	14.4	1200	250,000
OZ-210	23	600	250,000

ALLIS-CHALMERS

Will Defense Production Be Caught in the Squeeze?

When Congress revised and extended the Defense Production Act, it relaxed a squeeze on business profits.

President Truman asserted that this action by Congress cripples the government in its effort to prevent inflation which, as he puts it, could lead to "enrichment and profiteering for the few, economic hardship and misery for the many."

He asked Congress to rescind its action.

This editorial—the second on problems presented by "escalator"clauses—aims to throw some light on this conflict of opinion.

The Squeeze

The squeeze on profits was imposed in the name of price stabilization. The idea behind it was simple. The *selling prices* of industrial products were to be held under a tight lid. But many industrial costs are affected by "escalator" clauses of one kind or another which tend to boost production *costs*. Thus, with rising costs and fixed prices, profits would be squeezed and much of the cost of defense would thereby be shifted from those favored by escalator clauses to business concerns.

The mechanics of this squeeze on profits were complicated. But here, in brief, is how it was to work. The first step was to require manufacturers to set ceiling prices, effective May 28, for their products.

These ceiling or maximum prices were to allow for increases in manufacturers' costs that had occurred since Korea. *But they did not allow for all increases.* Manufacturers, for example, could not include increases in indirect costs—office or selling costs. Neither could they, in calculating their new prices, include increases in the costs of materials or direct labor that had come after March 15. This was the first phase of the squeeze on profits.

The second phase was prepared by **not** putting a ceiling on costs. The Wage Stabilization Board said it could not disturb the operation of "escalator" clauses by which wage rates are geared to the cost of living. Moreover, nothing could be done to curb the operation of the farmers' "escalator" clause, the farm parity arrangement. Under it, the federal government underwrites higher prices for farm products to match increases in the cost of things farmers buy. So this left wages and many materials costs free to rise against a ceiling imposed on the prices of what industry has to sell.

Relief—at a Loss

On two conditions only would the Office of Price Stabilization permit a company to raise its prices and escape this squeeze. One of these was that increased costs had more than wiped out its profits; in other words, that it was operating at a loss. The other condition was

that the industry of which the company is a part was not, as a whole, making "excess profits." That is, the industry, as a whole, could not get price relief if its overall profits before taxes were greater than 85 percent of its average profits during the best three of the four years from 1946 through 1949. Many companies expected that their profits would be cut drastically before they could get through this narrow escape hatch.

When this squeeze on profits was set up, we were told that industry as a whole was reporting record profits. But, it was equally true that wage rates and farm prices also were at record high levels. And it was also true that, under the impact of rising taxes and the dislocations caused by the defense mobilization program, profits actually were on the way down.

Profits — Going Down

By the time Congress acted to relax the squeeze, corporate profits, after taxes, were running at a rate 20 percent lower than they had been six months before. And the clear prospect was that they would continue to decline.

So the issue put up to Congress was simply this. Should business firms stand so much of the brunt of the defense costs while "escalator" clauses continued to exempt organized workers and farmers from paying their share of those costs?

But this question actually is much broader than one of fairness or unfairness alone. One certain effect of such a squeeze on profits would be to undercut the capacity of private industry to install the new plants and equipment needed for our mobilization effort. Today — unlike World War II — private industry is financing almost all of our huge program to expand production. And about two-thirds of the money that has been plowed into the expansion and improvement of our industrial machine since World War II has come out of profits.

In view of all this, Congress decided last summer to relax the pressure on profits. This was done by the controversial Capehart Amendment to the Defense Production Act. This amendment has serious administrative weaknesses. But some measure with the same purpose is needed to maintain profits at a high enough level to finance the huge and continuing expansion of our industrial machine that is now underway.

Basic Issues

As soon as the amendment was enacted, the President asked Congress to revise the law again. The heart of his proposal was to restore to the Administration the powers it used last spring to arrange the squeeze on profits outlined here.

This controversy will continue. There can be no final answer to it as long as we have the economic controls made necessary by mobilization.

But if we look beneath the surface of this technically complicated controversy, we shall see clearly that the basic issues are:

1. Whether we really shall make an effort to distribute fairly the burdens of inflation caused by our defense mobilization —

2. Whether farmers and organized workers should be exempted from these sacrifices by escalator clauses — at the expense of the nation as a whole —

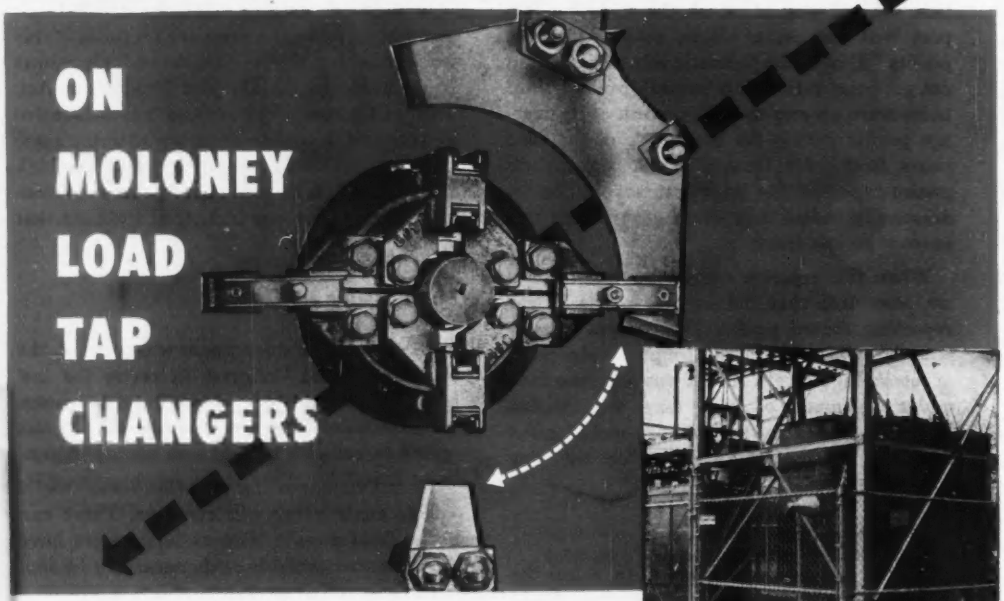
3. Whether profits should be squeezed still more — at the risk of putting a fatal squeeze on the effort of industry to build new plants and install new tools. These new facilities are essential to maintaining American living standards — and they are the heart of our ability to defend ourselves and the rest of the free world.

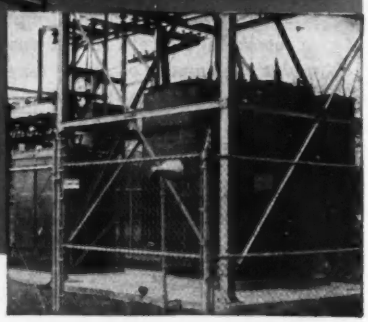
Americans face no more important economic issues at this time.

McGraw-Hill Publishing Company, Inc.

GREATER ARC CLEARANCE...

ON MOLONEY LOAD TAP CHANGERS





Provided on . . . Moloney Feeder Voltage Regulators • Regulating Transformers • Load Ratio Control Transformers

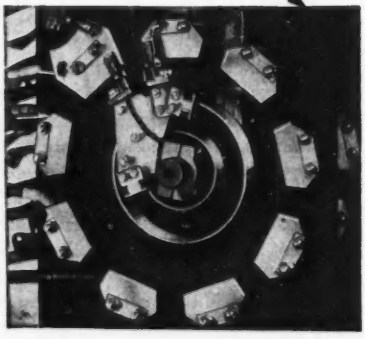
Load Tap Changers, provided on all Moloney Feeder Voltage Regulators, Regulating Transformers and Load Ratio Control Transformers, feature a Load Transfer Switch which relieves the Tap Selector Switch of all arcing duties and results in greatly increased arc interrupting capacity.

Use of the separate Load Transfer Switch permits longer arc clearances to be maintained since arcing duty is confined to but two stationary contacts per phase. This is in contrast to the nine stationary contacts per phase which are subject to arcing on regulators which require the Tap Selector Switch to break the load current.

This feature of the Moloney Load Tap Changer, along with the use of by-pass switching reactors, permits tap changing on a larger Kva load without increasing the physical size of the Load Tap Changing equipment. Maintenance costs are also reduced since arcing is eliminated from the Tap Selector Switch.

MEDI-14

NO ARCING HERE...



No arcing duty is imposed upon any of the tap selector switch contacts, avoiding the necessity for replacement due to burning or scoring. Contacts are of hardened *copper alloy* to minimize frictional wear.

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Editorials

Utilities Must Conserve Material

In 1951 the electric utilities will use less copper and aluminum than in 1950. In spite of this, generating capacity installed in 1951 will be much greater than that added in 1950. These were among the introductory remarks made by Thomas E. Marburger, director of the Materials and Equipment Division of Defense Electric Power Administration, before the Transmission and Distribution Committee of Edison Electric Institute at its meeting at Rochester, N. Y.

Looking toward 1952, Marburger said that structural steel will remain in short supply, copper availability will not increase, but aluminum will be more readily available. He predicted a slight increase in the aluminum supply in the second quarter, maybe 10% more in the third, and even greater quantities by the end of the year. With this picture as a background, Marburger had a number of recommendations for making the available materials go around in 1952. We believe these suggestions are of such significance as to justify reproduction here. They show how utilities can do their part in conserving scarce materials. The following are Marburger's recommendations:

1. **Do not use any programmed materials unless it is absolutely necessary.**
2. **Use galvanized steel wire for overhead shield and ground wires. Copper, aluminum, and even Copperweld are needed for more essential uses.**
3. **Use wood poles instead of steel towers in all possible installations.**
4. **Forget about duplicate lines for firming up power supply. Greater risks must be taken to conserve materials.**
5. **Eliminate spare equipment such as spare transformers, spare substation bays, spare breakers, etc.**
6. **If the interrupting capacity of breakers is too low, do not figure on replacing them until you have exhausted your engineering ability. Consider split-bus operation, use reactors on hand, change relaying if a back-up breaker of sufficient capacity can be coordinated.**
7. **Use capacitors for voltage improvement instead of larger conductor—suppose the voltage is not ideal; a lot of things are going to deteriorate during the next two or three years.**
8. **Street lighting improvement programs will just have to wait a couple of years.**
9. **Use aluminum in place of copper and be ready to swing back to copper if the supply picture changes because of adverse river flows, strikes or unforeseen conditions.**

In Marburger's closing remarks he emphasized even further the need for investigation of the possible use of aluminum in place of copper. "Regarding the future," he stated, "copper just will not be available. If you want to string lines, install buses, or run loops, it will pay you to investigate every possible use for aluminum wire—covered and bare."

The utilities have a big stake in the metals situation. They must, for their own sake, do everything possible to conserve material.

Really to See the Difference

Looking at $2 million in actual cash was a thrill. The episodes of "Flight into Freedom," showing the escape of a Russian through the Iron Curtain to this country, with narration by Douglas Fairbanks, Jr, gripped and held the attention. To see Mrs Anna Kasenkina limp to the microphone and to hear her few low-spoken words that ended with "God Bless America" as the orchestra softly played the melody, was an experience that none present will forget.

These were features of the announcement of the Crosley nationwide essay contest on the subject, "What the American Way of Life Means to Me." They were impressive examples of the superlative showmanship this company has brought to the selling of electric appliances.

But, effective as these features were in impact on the mind and the emotions, a greater result was produced by a more prosaic thing. This was an exhibit of appliances, radios, and television sets in which products from Europe, some from Russia and its satellites, were paralleled with their American counterparts. Here the realities of the difference between here and there were plain to sight and touch.

A "Peoples" radio from Hungary, pre-set to receive only three wave lengths, and they filled with government propaganda, in comparison with the free-tuning receivers of the Western nations, gave actuality to what had only been heard and read about before. A water heater of 2.6-gal capacity made one wonder what such a meager supply of hot water could be used for. And to look at a refrigerator of 1.22-cu ft capacity with a 7-ounce ice cube output was really to understand that phrase, "The American standard of living," used so often that people don't take time to grasp its meaning.

The Crosley people had a hard time collecting these exhibits. Only radios could be obtained from the communist nations, presumably because electric refrigerators, water heaters, and ranges are not generally available in those countries. But the effect of the exhibits was well worth the cost and effort of obtaining them. They will be shown over the country, but at best only a comparatively few thousand people can see them. All should.

Why Should Employees Talk?

Employees are not talking to the public. This statement has been made or implied so many times at industry meetings that it has become monotonous. Naturally the statement does not mean that the employees have taken a vow of silence but rather that they are not talking to the few people they meet about the industry, or the company, and its problems. The big problem, of course, being that of competition from subsidized public power.

Just why taking employment with a utility automatically makes one a roving ambassador of good will for the industry or company is never explained. What other industry expects as much of its employees?

If the utilities want the public to understand their problems, the thing to do is to build up their public relations departments, hire competent public relations experts, and give them freedom of operation and ample funds. The companies can also do one other important thing. They can join the four big industry associations that are doing a good job telling, directly or indirectly, the industry's story to the public. If all companies were members of these associations there wouldn't be any need for bemoaning the fact that employees aren't doubling as ambassadors of good will.

Must TV Stunt Our Mental Growth?

Describing television as a second industrial revolution, a representative of a large television manufacturer recently asked a group of utility and electrical industry men some questions which seem to us to get to the crux of the whole TV problem. "What," he asked, "will we build with the gains of this second industrial revolution? Will the ease with which TV brings us entertainment, education, and culture make us lazy and rot our curiosity and initiative?" Good questions these, and vitally important to the future of our nation.

If television is to be in the homes of 80% of our nation's families, as this spokesman predicted, it seems destined to become the dominating medium of communication in our national life. If the viewing public is satisfied with the Berles and Cassidys and Gorgeous Georges to the extent that it resists an interleaving of worth-while programs which will stimulate thought and impart worthwhile information, the overall impact on our national life could be disastrous. The industry—and the advertisers who support it—can go only so far in providing balanced programming. Beyond that point they must cater to the public demand.

It might be well for the industry to ponder this longer viewpoint, to the end that the public will be encouraged to want something more than entertainment from its window to the world. As this one speaker concluded: "If we are to benefit from the revolution, we must use it to stimulate our urge to progress and advance in all fields. What TV does to and for us as individuals and as a nation is up to our own individual initiative and foresight."

One-Ampere Current Transformers

Seven years ago Electrical World tacitly advocated consideration of a system of instrument transformer metering based on 1-amp secondary currents instead of the conventional 5-amp. Nothing much seems to have been done about Lloyd Hunt's proposal—(EW, June 24, 1944, p. 59), but the increasing shortage of copper justifies analysis of a technique that could save up to 150 lb of copper in an installation involving 500-ft runs of the secondary leads. At the Hoover Dam plant the saving on a 3,800-ft run was 2,400 lb. Unless there are more hidden cons than evident pros the proposal should be dusted off and reexamined in the interest of conservation.

The Electrical Week

INDUSTRY MOBILIZATION (Page 95)—Slash in materials allotments for first quarter will slow the industry's expansion program . . . Form DEPA-8 has been revised. More information concerning material for minor requirements must be submitted . . . Substation steel purchased in connection with switchgear from the switchgear manufacturer is now classified as a "B" product, and utilities need no longer file a Depa allotment to get it . . . Parker J. Davies becomes a Depa engineer.

WASHINGTON—Beidatsch and Rainey appointed to OPS Public Utilities Branch (p 90) . . . Reynolds Metal Co authorized to expand its aluminum facilities in Arkansas (p 91) . . . Vepco seeks FPC license for second Roanoke River project (p 92) . . . Congress sidetracks three power project bills (p 94) . . . SEC gives American Power & Light until Jan. 1 to arrange sale of Washington Water Power common stock (p 96).

ELSEWHERE—AEIC meeting stresses research and development leading to better power systems (p 88) . . . Marburger warns EEI T&D Committee copper will not be available for utility distribution systems (p 89) . . . PEA's T&D group discusses aluminum for distribution (p 90) . . . Boston Edison Co is much in favor of reheat, EEI Electrical Equipment Committee is told (p 92) . . . Distribution and servicing of appliances and equipment considered at National Farm Electrification Conference (p 93) . . . International Association of Electrical Leagues discusses how members can best serve the nation and their industry in the present arsenal economy (p 94).

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LATEST FROM WASHINGTON—Total of 180,000 kw will be needed to serve Savannah River H-bomb materials plant. AEC plans to install 75 to 80% of this on site and buy remainder from private companies (see next item) . . . Need for power in Northwest moved a conference committee to recommend funds for Albeni Falls and The Dalles projects denied by the House. Figures for McNary, Detroit, and Lookout projects were upped . . . Wisconsin-Michigan Power has secured a license for a second hydro project in Iron County, Mich.

South Carolina Generating Co, wholly owned subsidiary of South Carolina G&E, has applied to the Public Service Commission for permission to build a 150,000-kw, base-load plant near Aiken on the Savannah River to supply AEC's H-bomb materials plant. The utility is negotiating contracts concerning the amount and cost of power to be supplied.

North Carolina's Governor Scott says electric companies "haven't got any surplus of electric power, haven't had any, and I don't see one in the foreseeable future." He also backs Interior Secretary Chapman in opposing Virginia E&P's Roanoke Rapids project. "The cream is in that dam so far as Vepco is concerned. After all, if it is cheaper to build steam electric than hydro plants, why don't they go ahead and build them?"

Drought continues in the Southeast. Some industrial customers in the Carolinas have been affected. One is Alcoa plant at Badin, N. C. . . . The House-Senate Defense Production Committee has directed its staff to study power supply problems of aluminum industry and report on its findings in January.

Kansas State Corporation Commission orders Kansas P&L to file new rate structure on or before Dec. 15 to take effect Jan. 1. New schedule would produce gross electric department revenues of over $20 million based on estimated 1951 sales.

National Association of Railroad and Utilities Commissioners convention—Rep Boykin, Ala. Dem, in lashing out at public power said, "Bureaucrats don't use the law. They use directives. You couldn't run a business that way. A corporation can run anything in the world better than the U. S. government."

An attempt by a group of stockholders including Electric Bond & Share to elect W. C. Gilman, president of Florida Power Corp, to the board of American Power & Light has been defeated at least for a time. Pres H. L. Aller of AP&L ruled that Gilman was the candidate of "certain investment bankers and brokers" and therefore ineligible under Section 17(C) of the Public Utility Holding Company Act. The slate backed by AP&L management was elected.

Tulsa citizens voted 20-1 to give Public Service Co of Oklahoma a 25-year franchise, permitting the utility to start a $25-million expansion program.

Southern Co and its four operating companies have started a national advertising campaign in magazines and metropolitan newspapers to boost their territory as the location for industrial plants.

Congratulations—Donald M. Mackie, Commonwealth Services, Inc, public relations director, is elected New York Council of the Navy League president.

AEIC MEETING heard Depa Administrator James F. Fairman, left, discuss mobilization problems. P. H. McCance, center, was re-elected association president. F. V. Magalhaes, AEIC secretary-treasurer, made arrangements for the meeting

AEIC Meeting Stresses Research Leading to Better Power Systems

Research and development leading toward improved design and operation of electric power systems were the themes of the annual meeting of the Association of Edison Illuminating Companies. It was held Oct. 11-13 at White Sulphur Springs, W. Va. Pres P. H. McCance, Duquesne Light Co, and all other officers were reelected.

Effect of materials shortages upon the industry's expansion plans and need for adjustments to the impact of this situation were discussed by Pres P. H. McCance. He urged a review of load estimates so that they will conform with changing conditions. Rate increases will be needed to meet rising costs, he added. In referring to the manpower shortage, McCance said: "We not only need new employees for new jobs, but we need new employees for old jobs." The industry offers positions not equalled by many industries. He praised the utilities for their ability to keep power station costs low in spite of higher labor and material costs and their operation of combined systems to secure maximum use of equipment.

Reporting for the executive committee, F. V. Magalhaes, secretary-treasurer, said that a substantial sum was being spent for research activities. Research in steam contamination is one of the important projects.

A. D. Bailey, Commonwealth Edison Co, who presided at the session devoted to reports of technical committees, emphasized the need for long-range plans to sell the utility industry to young engineers. He also stressed desirability of expanding use of remote controlled substations to save manpower.

Reports on load research and technical committee activities were reported by the following: Load Research by C. M. Turner, vice chairman; air pollution policy by P. W. Thompson for L. B. Bonnett, chairman; electric switching and switchgear by L. R. Gaty, chairman; metering and service methods by R. H. Thomas for F. H. Rogers, chairman; power distribution by C. W. Franklin, chairman; and power generation by F. P. Fairchild for T. E. Purcell, chairman.

Reports of the technical committees showed stepped-up activities in studies of load characteristics and equipment design and performance. Recent projects of the load research committee include electric house heating, air conditioning in commercial establishments, and load characteristics of rural lines. The need for appropriate rate schedules for house heating and research in methods of improving the load factor of the various types of equipment was pointed out. Commercial air conditioning was found to have a high group coincident factor and a low load factor of about 15%.

Air pollution policy—It has not been shown that people are affected by sulphur dioxide which appears in stack gas in percentages not exceeding 0.35%. Studies of this gas as a pollution factor have been restricted because of lack of low cost automatic recording instruments.

Metering and service methods—It was recommended that methods of meter testing be analyzed to find cheaper ones. A sufficient supply of meters to avoid unmetered service was held to be a good way to save materials during the emergency. Home use may be up 50% when unmetered.

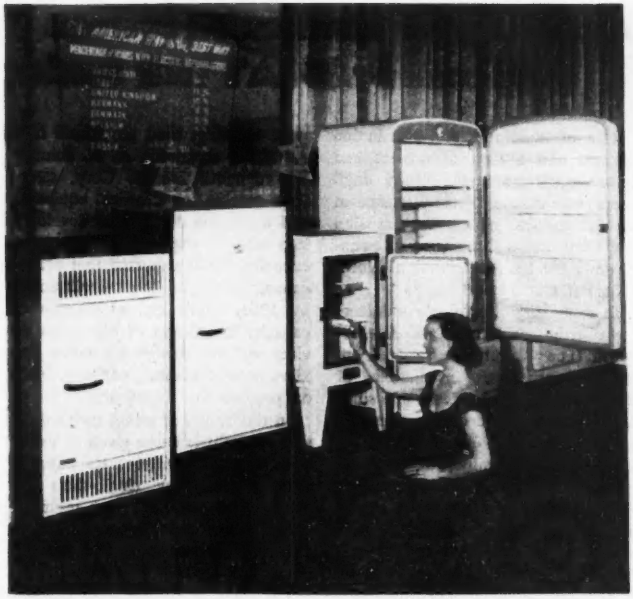
Power distribution—The use of high voltages up to 69 kv even for short subtransmission and distribution lines has been found to produce considerable savings. Because of the danger of excessive heating in low voltage switches rated 3,000 amp and above, the use of higher voltages wherever possible was recommended.

Power generation—The predominant size of generating equipment on order today is 100,000 kw for operation at 1,800 psi and 1,000 F.

J. W. Parker, Detroit Edison Co, reported on the cooperation of utilities in investigating the feasibility of the use of atomic energy for power generation. Four companies are now making pre-feasibility studies. Soon all utilities will have to decide whether they will take an active part in the development of this source of power.

W. T. Reace, Commonwealth Edison Co, presented a report from the sales executives conference. Papers prepared by W. H. Sammis, Ohio Edison Co, and M. E. Skinner, Union Electric Co of Missouri, for the sales executives conference were repeated for the AEIC group. Depa Administrator James F. Fairman reviewed the electric power situation.

M. E. SKINNER, left, Union Electric Co vice president, chats with Pres W. H. Sammis, Ohio Edison Co, between sessions



'AMERICAN WAY' exhibit, staged recently in New York, kicked off Crosley's $2 million, 50-word essay contest on "What America Means to Me." (See Page 86.) Here model Lauri Collier compares size and quality of West German model refrigerator with U. S. unit at right. Swedish and Danish models are shown at the left

Marburger Warns EEI T&D Group Utility Systems Won't Get Copper

"It will pay you to investigate every possible use of aluminum, both covered and bare, if you want to string lines, install buses, or run loops. Copper just will not be available in the period ahead."

With this warning Thomas E. Marburger, director of Defense Electric Power Administration's Materials and Equipment Division, urged Edison Electric Institute's Transmission and Distribution Committee to "go all out" in use of aluminum wire and cable. The committee met Oct. 10-11 at Rochetser, N. Y.

Marburger described as "woefully disheartening" the response to Depa's summer announcement that covered-aluminum wire was available without restriction and upon request. "Evidently utilities thought that somehow they would get the copper needed."

Designation of a special subcommittee to recommend standard sizes, stranding, and direction of lay of aluminum wire culminated in a slam-bang discussion of seeming inconsistencies in copper and aluminum wire tables.

The discussion started when David Burns, Detroit Edison Co, called attention to use of left-hand lay for covered aluminum wire and right hand for bare conductors and the listing of aluminum in "copper equivalent" as well as even-numbered circular mil sizes of almost identical area, such as 336,400 and 350,000 circ mil.

L. F. Hickernell, Anaconda Copper Co, urged the group to coordinate its efforts closely with American Society for Testing Materials, which has been studying the problem for two years. Bryce Brady, Oklahoma Gas & Electric Co, urged standardization of "copper equivalent" sizes for aluminum wire in order to simplify distribution calculations.

Charges that system secondary voltages as high as 260 v were damaging 220-v motors of unit-type air conditioners were made by representatives of the air conditioning industry. While such motors have a voltage range of 220 v ± 10%, current EEI-Nema system preferred voltage ratings allow a "tolerable voltage range" on utility systems of 228 to 252 v on a 120-v base. Such divergence between the 242 v (10% plus) top of the manufacturers' rating and the 252 v of EEI-Nema rating leaves a no-man's land where equipment guarantees no longer apply. Speakers for the makers of air conditioners were W. B. Henderson of Air Conditioning and Refrigeration Manufacturers Association; W. L. McGrath, Carrier Corp; and R. A. Gonzales, Chrysler Corp.

Reports on Survey Results

Summarizing a survey of service entrance voltages, made on recommendation of air conditioning manufacturers, J. W. Anderson, Philadelphia Electric Co, said tests by 17 companies showed mode, median, and average voltages of 120, 118.9, and 118.2 respectively. Of 34 companies replying 25 had a system base voltage of 120, three of 115. The 34 companies represent 40% of the industry.

With at least $8 billion invested in distribution systems, it seems profitable to determine what types of construction and protection are preferable from standpoint of overall economy and service reliability. This was the introduction of C. J. Beller, Cleveland Electric Illuminating Co, to a joint AIEE-EEI committee report on the subject.

Outage Causes Listed

Harold Cole, Detroit Edison, said 31 utilities supplied 1949 outage data for the report, covering 173 circuits comprising 4,654 miles. More than half the 617 faults reported were of weather origin, and 65% were persistent. Wind faults predominated and were largely persistent. Trees were involved in 41%. G. B. Dodds, Duquesne Light Co, presented the data on the protective aspects.

Utilities can alleviate their tree conflict difficulties by encouraging the planting of low-growing varieties, P. E. Tilford, National Arborist Association, told the group. He mentioned these: Hawthorn, flowering crab, golden rain, certain maples, hornbeam, globe-headed elms, linden, bass-

wood, and locust. Poor location is a second factor deserving educational effort.

Panel discussion of safety practices in use of diggers and derricks was participated in by four companies. One uses only four-wheel drive units; another finds their maintenance too expensive; a third has reverted entirely to conventional drive with no power take-off. The latter buys extra-sturdy equipment on the premise that long life and least maintenance warrants the added outlay.

A round table discussion of manhole and vault explosions and a review of mechanizing construction included films from Cleveland Electric Illuminating Co, Union Electric Co of Missouri, Niagara Mohawk Power Corp, and Consolidated Edison Co of New York. The films covered pavement breaking, manhole excavation, duct rodding, pneumatic water pumping, and materials handling.

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Named by Florida RPUC

A. W. Braconsdale has been appointed director of the newly created Gas and Electric Department of the Florida Railroad and Public Utilities Commission covering gas and electric operations and regulation. Braconsdale will also serve as chief engineer of the department.

Aluminum for Distribution Systems Discussed at PEA's T&D Session

Use of aluminum for distribution systems and a look at present and future problems facing utility engineers were chief subjects discussed at the fall meeting of the Transmission and Distribution Committee of Pennsylvania Electric Association at North East, Pa., Oct. 11 and 12.

In discussing aluminum conductors for distribution circuits, E. E. McIlveen, The Okonite Co, pointed out that the numerous installations of aluminum wire and cable made since World War II provided an engineering basis of design and experience for increased use of aluminum as an alternative to copper. Once the uncertainty which surrounds application of aluminum is dispersed, he said, the economics of using it will swing the balance in its favor. As an example of the economic advantages of aluminum, he said that service drops consisting of two covered and one bare No. 4, hard-drawn aluminum wires weigh 71 lb less per 1,000 ft than their No. 6 copper equivalent and cost 40% less.

McIlveen said several manufacturers were making insulators, splices, and connectors for use with aluminum wire in distribution systems.

In outlining what the future holds for utility engineers, A. A. Johnson, Westinghouse Electric Corp, said a large market for electrical equipment and utilization devices will develop in step with the expansion in generating capacity. It is expected that present capacity of 74 million kw will double by 1961. Five kva of transformer capacity and 3 kva of utilization devices will be needed for every new kilowatt of generating capacity, based on present day experience.

In the design of steam turbines, he said, thought is being given to use of a turbine with five separate stages to drive a 200,00-kw, single-shaft machine. Two stages of reheat are in the offing, with increases in efficiency of 4% for the first stage and 2% for the second.

The trend in turbine design, Johnson continued, may well swing to small, high-speed, high-temperature, high-pressure units geared to conventional 3,600-rpm generators. These high-speed turbines may be built with a service life of only five years. His company can foresee the development of a 50,000-kw gas turbine, he declared.

Johnson posed the question of the advisability of keeping the high standards of electric service now being maintained on most utility systems. He asked if these standards were not too high and could not stand some relaxation.

'FREEDOM SERIES' films to be shown this fall to 2,300 employees of Connecticut Light & Power Co were previewed recently for CL&P discussion leaders by George R. Eckels of Middle West Service Co, which developed the program. The series, including "How We Got Freedom", "How We Can Lose Freedom", and "How We Can Keep Freedom", urges workers to take personal interest in guarding individual liberties

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Two Appointed to OPS Public Utilities Branch

Walter H. Beidatsch, formerly professor of economics at Ohio University, has joined the Public Utilities Branch of the Office of Price Stabilization in Washington. Before joining the university faculty, Beidatsch was chief economist of the Federal Power Commission staff during its investigation of the natural gas industry.

Merele Rainey, formerly superintendent of operations of the Fort Peck, Mont., field office of the Bureau of Reclamation, also has been named to serve with the Public Utilities Branch of OPS.

EXECUTIVE COMMITTEE for Industrial Electric Exposition included: (standing) C. R. Taylor, Allis Chalmers; T. M. Lukens, GE; W. D. Shaler, Electrical League of Western Pa., the sponsor; J. W. O'Nan, Duquesne Light; F. F. Dickmann, West Penn Power; (seated) C. J. Long, chairman; and C. D. Taylor, Jr, and E. A. Weisser, ELWP

Key to Production Cited at Industrial Exposition

"The key to production is getting along with people," T. O. Armstrong, Westinghouse Electric Corp, told the third annual Industrial Electric Exposition at Pittsburgh Oct. 9-11, sponsored by the Electric League of Western Pennsylvania.

Armstrong said we must remember individuals are different and have different viewpoints toward their problems. Our task, he said, is to increase our ability to recognize these differences, and deal with them individually.

B. A. Fleming and C. F. Kreiser of Edwin L. Wiegand Co discussed late developments and applications of radiant infra-red heating. Other speakers and their subjects included Joseph C. Thompson, Pittsburgh Plate Glass Co, "Painting the Factory for Production"; Richard P. Bell, Pittsburgh Plate Glass, "Decoration in Your Home"; R. S. Rice, "Factory Management and Company Maintenance", "Better Materials Handling for Production"; Arthur G. Hopcraft, Cleveland Worm & Gear Co, "Purchasing for Production"; Will S. Fisher, General Electric Co, demonstration on relation of lighting to production and accidents.

'Sunny Florida P&L'

Visiting stockholders of Florida Power & Light Co get even better treatment than visiting firemen when they come down to Miami to look over their properties.

Each of the firm's 30,000 owners receives a membership in the Sunshine Service Club, entitling him to assistance from the company in making the trip. Among other things, the utility arranges hotel reservations, automobile trips, and plant inspection tours for junketing shareholders.

To Expand Aluminum Plant

Reynolds Metal Co has been authorized by the federal government to expand its Arkansas aluminum production by 60,000 tons annually. The company will either expand present facilities at Jones Mills, Ark., or build a new plant. An addition to increase by 1,000 tons daily the production of alumina—the powder from which the metal is derived—also will be constructed, according to the letter of intent granted the company.

Everybody Wants to Be a Member of the FPC

Candidates are being lined up on all sides to fill the vacancy on the Federal Power Commission caused by the resignation of Chairman Mon C. Wallgren.

A delegation of Pacific Northwest lawmakers called on President Truman last week to again urge the nomination of Irving A. Hoff, administrative assistant to Democratic Sen Warren C. Magnuson of Washington. Sen James E. Murray, Democrat of Montana, as well as two Democratic representatives from Washington joined Magnuson in supporting the candidacy of Hoff.

But the women had a different idea. Mrs. India Edwards, vice chairman of the Democratic National Committee and a well-known "queen-maker," wants former Congresswoman Chase Going Woodhouse of Connecticut to become the first woman member of the FPC.

The FPC staff believes one or two of its members might qualify for the position, and point out that President Truman has given career men a break in filling appointments.

From the Southwest, a potential chairman of the Democratic National Committee, Sen Robert S. Kerr, was reported to have a candidate. He told a reporter: "I'd rather not tell you his name until he is appointed."

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Asks Congress for Funds to Finish Idaho Project

Chances for continuing construction of the $76 million Palisades Project on the Snake River in southeastern Idaho have been given a shot in the arm by President Truman.

The President's Budget Bureau reversed a decision of earlier this year, and asked Congress to appropriate $2 million for continuing work on the 112,000-kw project.

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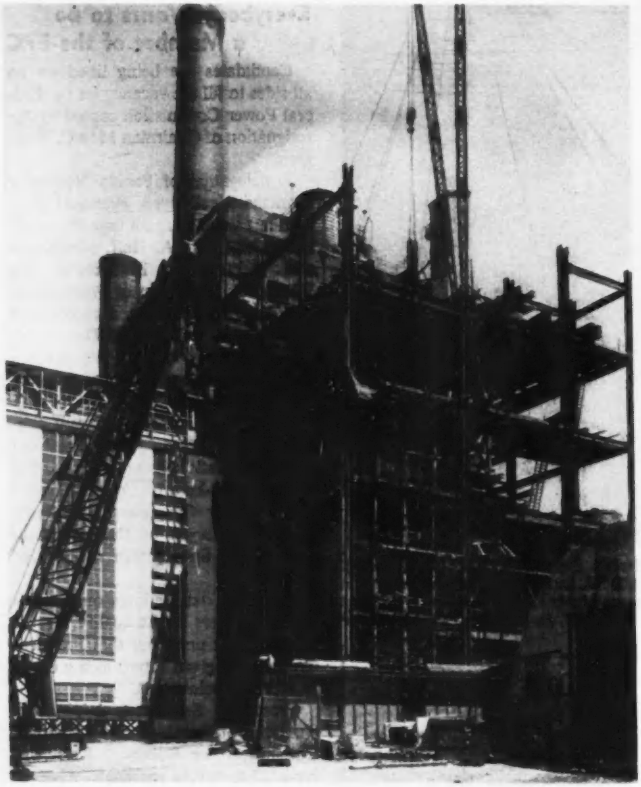
Assignment in Liberia

Robert R. Williams, Bureau of Reclamation engineer, has left for Monrovia, Liberia, on a one-year assignment to investigate possible hydroelectric power development sites on the St. Paul River. The trip was arranged under the Point Four Program.



EDGAR STATION'S second 81,250-kw steam unit, shown under construction, will use reheat, Boston Edison Co official told EEI Electrical Equipment Committee. Boiler is rated at 583,000 lb per hr, 1,450 psi, and 1,000 F with reheat to 1,000

Reheat Favored by Boston Edison, Official Tells EEI Equipment Group

Operating performance and maintenance experience on the reheat turbines installed at Boston Edison Co's Edgar Station in the twenties has been so satisfactory that reheat was adopted for the recent 100 Mw, 1,400 psi, 700 F addition.

G. A. Orrok of Boston Edison reported this to Edison Electric Institute's Electrical Equipment Committee, which met recently at Swampscott, Mass.

The new unit has had a one-year service demand availability factor of 92½% and a capacity factor of 88.9%. Inexpensive coal silos were installed in lieu of orthodox suspended bunkers. The electrical pattern holds to the vertical phase isolation, has a synchronizing bus, and a main bus normally operated in three sections, according to C. W. McGill, also of the company. Resort to a two-winding generator (leads brought out on opposite sides) reduced fault current for each bus section; otherwise a breaker rating not available would have been needed.

Departures in Duquesne Light Co's new Elrama Station were described by J. S. Brown of the utility as embracing Q-panel siding, a control house projecting between outgoing transformers (neutral equipment on the roof), shaft generator for auxiliary supply, and flywheel-type motor-generator exciter sets. Auxiliary supply will be "voltage-chased" and transferred "dead" in about 100 cycles. Control room lighting will be plastic-louvered. Brown said the third unit will have a capacity of 125 Mw with reheat.

Correlation between dielectric power factor and dc absorption was reported by R. J. Hirsch (Shawinigan Water & Power Co) as affording an extrapolative index of generator insulation deterioration.

H. E. Deardorf said Dayton Power & Light Co henceforth will have only 12 kv distribution, largely because that voltage would be needed anyhow to feed any retained 4 kv substations in the city from the 66 kv transmission ring around it. The voltage provides for load growth.

Committee members favored a National Electrical Manufacturers Association proposal to render transformer bushings interchangeable, although the reduced flange diameter may prevent use of some prevailing spare bushings in new transformers while permitting adaptation of new bushings to existing transformers.

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Vepco Seeking License for 2nd Roanoke Project

On the heels of its victory in the Roanoke Rapids case (EW, Oct. 15, p 5), Virginia Electric & Power Co has applied for a federal license to build a second hydroelectric project in the Roanoke River basin.

The company is asking Federal Power Commission approval to construct the Gaston Project, one of 11 laid out in the comprehensive basin development drawn up by the Army Corps of Engineers.

Located 35 miles below the present Buggs Island Project, Gaston would include a concrete dam 2,580 ft long with a powerhouse section and an 18,500-acre reservoir. The powerhouse will have three 29,000-kw generators with space for a fourth unit.

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New Building Acquired

Armour Research Foundation of Illinois Institute of Technology has signed a five-year lease for the two-story Irwin building, 3201 S. Michigan Avenue, to house its electrical engineering department.

PARTICIPANTS from all phases of farm electrification attended conference. Among them were C. E. Seitz, left, Virginia Polytechnic Institute; Claude R. Wickard, REA administrator; R. E. Johnson, Toledo Edison Co; and Russell Gingles, NEMA

Farm Electrification Group Considers Distribution, Servicing of Appliances

Distribution and servicing of electric appliances and production equipment are perennial problems in farm electrification. Again, at the recent National Farm Electrification Conference at Cincinnati, as in the five previous annual meetings of this group, these two subjects received major attention.

A particularly sore spot, discussion developed, is the dealer who sells both electric and liquified gas appliances. His right to keep his electric goods franchise was questioned. Manufacturers could do much to cure this condition, it was said.

Inadequacy of wiring to the point of real danger was another subject of concern. Here, also, the dealer was on the receiving end. He sells a major appliance in blithe disregard as to the ability of the buyer's wiring to handle the added load, speakers asserted. Then, they said, the appliance maker or the power supplier is blamed for unsatisfactory operation. Criticism was voiced against makers of appliances and equipment for not accompanying their products with enough information on construction and operation so simple repairs could be made by the user without having to call a service man.

George M. Gadsby, Edison Electric Institute president, emphasized the part to be played in electrification of agriculture by farm youth.

"One phase of the job ahead which in my opinion is of vast importance," he said, "is preparing the farm boy and girl to fill their roles in the years to come in advancing electrified farming and electrical living on the farm. For progress in the future it is incumbent on all of us to see that the ingenuity and resourcefulness, the character and industry of today's farm youngsters are directed so as to assure their interest and enthusiasm in the long climb towards improvements that lie ahead."

Claude R. Wickard, Rural Electrification Administrator, said progress in the use of electricity on farms rests not with individual farmers but with the people who shape policies in education, manufacturing, and distribution. Such progress, he said, depends on providing reliable, low-cost service, on developing dependable equipment to use electricity in profitable ways, and furnishing help in the selection, installation, care, and operation of this equipment.

New officers elected were: Chairman, John Strohm, associate editor, "Country Gentleman;" and vice chairman, H. E. Slusher, Missouri Farm Bureau Federation. Russell Gingles, National Electrical Manufacturers Association, and Karl H. Gorham, "Electricity on the Farm," will continue in their respective offices as secretary and treasurer.

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Says Industry Must Use Kwhr Instead of Man-hr

The power sales job for the coming year is to help industry substitute kilowatt hours for man-hours to reduce production costs, said Robert G. Ely, Connecticut Light & Power Co, in addressing members of the Interstate Power Club in New York Oct. 8.

Ely said the manpower needs of the armed services, the heavy demands for manpower to operate a completely controlled economy, and the increased manpower requirements for war production were draining the available supply.

Ed Vennard, Middle West Service Co, said the way to keep freedom was to inform people as to economic facts and principles. The American people, he said, are intelligent enough to form their own conclusions on ideology, once they are given the facts. There are still many furnace jobs going to gas which could be electric, according to A. D. Spillman, Philadelphia Electric Co. He said this would not be the case if power companies and manufacturers had more complete information on all cost factors. Cost studies of this kind, he said, require a great deal of time. "We in the electric utility business can contribute greatly to the industry by making tests and overall cost studies of major furnace applications."

Some day natural rubber will be a curiosity, said S. J. Rosch, Anaconda Wire & Cable Co. He outlined the new developments in synthetic rubber, synthetic resins and plastics in general. He said polyethylene was the only known insulating material that will withstand handling at −70C.

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25-Year Franchise OK'd

Northern Arizona Light & Power Co has been voted a 25-year city franchise by the Prescott, Ariz., electorate, which will become effective within 30 days.

Electrical Leagues Urged to Assist U. S., Industry in Arsenal Economy

How electrical leagues can most effectively serve their industry and the nation in our present arsenal economy was the overriding concern at every session of the 16th annual conference of the International Association of Electrical Leagues in New Orleans, La., Oct. 10-13.

Specific suggestions in that direction were offered by R. B. Hubbard, association vice president. In addition to their usual activities, he said, leagues might consider: Becoming clearing houses for available supplies of motors, transformers, conductors, repair parts, any and all scarce electrical items; conduct salvage drives for critical materials; keep active files of rules, regulations, and restrictions affecting the industry; take active part in local and state civil defense work; and cooperate in service and repair arrangements to keep appliances in working condition.

The arsenal economy has already had great affect on appliance production, said Harry J. Holbrook, director of National Production Authority's Consumer Durable Goods Division. Major savings in use of scarce metals have been made by manufacturers. We have now come to the point, he said, when there will have to be a further tightening of the belt.

He said the increase in military production and the demands of defense-supporting industries are such now that the amounts of copper, aluminum, stainless steel, cobalt, and nickel available for the consumer goods industries will be smaller for at least the first half of 1952.

After the first round of appliance redesign for metal conservation, now ended, the cream of possible savings has been skimmed off. Ahead now is a much harder job as further cuts in availability of metals become necessary, he said. From all present indications, he added, production of electrical appliances will be at a minimum for at least the next nine months, if not longer.

New houses can be wired adequately within the 35-lb copper limit according to a study reported by Herbert E. Cook, Electrical Association of Detroit. The "Adequate Wiring Program," as respects most houses now being built—1,500 sq ft and less—can go forward under present copper restrictions. This will require engineered wiring layout, with particular attention to location of the service entrance.

Officers elected for the coming year were J. G. Waddell, president; R. B. Hubbard, vice president; A. C. Maillard, treasurer; and J. A. Morrison, secretary.

LOOKOUT POINT DAM, near Eugene, Ore., has progressed to the point where its concrete spillway section is being poured. The 115,000-kw installation, a Corps of Engineers project on the Willamette River, is to be finished in 1954

Congressmen Sidetrack 3 Power Project Bills

In the rush to close up shop for the year, Congress last week sidetracked three major bills dealing with electric power projects. This means further consideration will be delayed until Congress reconvenes in January.

The bill which would authorize government construction of eight thermal plants to supplement the Bonneville system was buried in the House Rules Committee, after the House Public Works Committee had approved it, 15-9. The Senate must also consider the bill.

Should the Public Works Committee report out the St. Lawrence Seaway bill, a similar fate appeared in store for it. Committee approval of the bill appeared to hinge on the vote of Tom Steed, Democrat of Oklahoma. He is against it for the time being, but may change his mind if action is put off until January.

Redevelopment of electric power from Niagara River in the vicinity of Niagara Falls was still being considered by both House and Senate Public Works Committees. Neither group seemed in a hurry to make up its mind as to whether the redevelopment should be done by the federal government, the State of New York, or private enterprise.

Pend Oreille PUD Gets Box Canyon Dam License

Public Utility District No. 1 of Pend Oreille County, Wash., has asked the Federal Power Commission for a license to build a $16-million hydroelectric project on the Pend Oreille River.

The proposed project, known as Box Canyon, would consist of a 260-ft dam and a powerhouse 400 ft downstream from the dam. The plant will house four vertical units of 15,000 kw each.

DPA ADVISORY COMMITTEE reviewing the electric power industry consists of Herbert Marks, left, former Office of War Utilities counsel; Edward W. Morehouse, committee chairman, vice president of General Public Utilities Corp; G. O. Wessenauer, manager of power, TVA; and Ralph Booth, Jackson & Moreland, Boston engineering firm. The committee is now visiting electric companies throughout the country to get firsthand information about their expansion plans

Slash in 1st Q Materials Allotments Will Slow Expansion of the Industry

Continued slowdowns were indicated in the expansion program of the electric power industry with announcement of first quarter 1952 material allotments.

For every industry claimant agency allotments were again below requests. However, the figures did indicate that the allocators are following a pattern of taking care of the long-lead-time equipment and hoping for expanded supply of materials for the shorter lead-time articles.

Hardest hit by the first quarter allotments is the Electrical Equipment Division with cuts under requests ranging from 25 to nearly 50%. This National Production Authority division claims materials for manufacture of items such as transformers, switchgear, poleline hardware, as well as lighting fixtures, and large and small motors.

Relatively unscathed was the Engine and Turbine Division of NPA whose allocations nearly measured up to requests. Since the division claims materials for manufacture of heavy long-lead-time items such as boilers, turbines, and generators, it is apparently faring well.

Defense Electric Power Administration, which claims materials for the utilities, received allotments about on level with the fourth quarter of this year.

In cutting down Depa requests, Defense Production Administrator Manly Fleischmann explained it was necessary to bring them into line with the amount of heavy electrical equipment that will be available for new plants.

CMP Metals for Power Agencies

Requests and Allotments for 1st Quarter 1952

Metal	1st Quarter Allotments	1st Quarter Requests	4th Quarter 1951 Final Allotments
Defense Electric Power Administration			
Steel (tons)	309,550	398,765	309,176
Copper (lb)	79,050,000	94,894,000	80,852,000
Aluminum (lb)	39,000,000	55,452,000	35,500,000
Electrical Equipment Division of NPA			
Steel (tons)	586,710	875,500	574,987
Copper (lb)	147,169,000	242,119,000	160,458,000
Aluminum (lb)	24,250,000	45,515,000	28,313,000
Engine and Turbine Division of NPA			
Steel (tons)	580,500	607,179	548,755
Copper (lb)	29,930,000	33,693,938	21,664,320
Aluminum (lb)	3,900,000	3,958,342	3,409,902

Form DEPA-8 Revised, Asks More Information

Form DEPA-8 used by utilities in reporting information concerning controlled material for minor requirements has been revised.

Defense Electric Power Administration, with which the forms are filed, called attention to the section of the new form dealing with base period figures. Utilities are asked to refile all information needed to fill in this section because of the many reclassifications which have been made in controlled materials.

In a few instances, utilities have failed to file the original Form DEPA-8. Unless steps are taken to remedy this, utilities may be subject to loss of priorities assistance.

Some Substation Steel Designated 'B' Product

Substation steel, purchased in connection with switchgear from the switchgear manufacturer, has been reclassified under CMP regulations.

Such steel is now designated as a "B" product, and utilities are not required to file for an allotment from Defense Electric Power Administration.

Where utilities have already applied for such an allotment, amendments to the revised Form-9 should be filed with Depa immediately. If this reclassification will result in delayed in service operation of a substation, utilities are asked to call on Depa for procurement assistance in accordance with order EO-2.

Joins Depa Engineers

Parker J. Davies, supervisor of system voltage control for Pennsylvania Power & Light Co, has received an eight-month leave to join the Regional Engineering Staff of Defense Electric Power Administration.

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1951									
Oct. 11	2.88	2.92	3.07	4.09	4.30	4.63	5.46	6.21	6.97
Oct. 4	2.88	2.91	3.07	4.08	4.28	4.63	5.49	6.21	7.04
END OF QTR.									
3rd 1951	2.87	2.91	3.04	4.05	4.27	4.61	5.52	6.24	7.05
2nd 1951	3.02	3.11	3.23	4.11	4.37	4.68	5.73	6.38	7.78
1st 1951	2.87	2.93	3.00	3.96	4.19	4.52	5.47	6.20	7.13
4th 1950	2.65	2.67	2.78	3.86	4.14	4.51	5.80	6.54	7.44

Data: Reis & Chandler, Inc.

SEC Gives AP&L Until Jan. 1 to Sell Washington Water Power Holdings

American Power & Light Co has until Jan. 1 to arrange a sale of its holdings in Washington Water Power Co to public utility districts in the Pacific Northwest. The holding company has been ordered by the Securities and Exchange Commission to distribute WWP's common stock to its own stockholders if a sale is not concluded by that date.

American's president, Howard Aller, said he expects to have an offer for the sale of WWP by Jan. 1. Earlier a group of Washington PUD's offered $70 million for the properties but the sale was blocked by a court order.

SEC also authorized American to distribute a $2 common share liquidating dividend to its stockholders. The distribution amounts to $4,684,822. The holding company has been in the process of dissolution since 1942. Washington Water Power is its last major holding.

At a hearing before SEC in August (EW, Sept. 3 p 4) American argued that it could get a better deal for its stockholders by selling WWP to the PUD's than by distributing WWP stock to them. American's management promised to distribute the stock if a sale could not be arranged by Jan. 1.

Under these circumstances, the commission said, it did not feel it was justified in superseding the judgment of management. "However," SEC added, "we cannot permit this condition of stalemate to continue indefinitely."

Accordingly, the commission ordered American to file a plan by Nov. 5 for distribution of the Washington stock in order that the distribution can be expedited if the company has not filed a notification of sale by Jan. 1.

Electric Bond & Share Co, which has opposed American's attempts to sell WWP to public power groups, has been ordered by the SEC to sell or distribute its holdings of American's stock by Jan. 1. Bond & Share holds about 8% of American's common stock. It also must file by Nov. 5 a plan for disposing of WWP stock in the event it is distributed by American.

FINANCIAL BRIEFS

Public Service Commission has set Oct. 30 to hear certain changes in South Carolina Electric & Gas Co's electric and gas rate schedules . . . **Missouri Public Service Commission** has suspended for four months $333,613 a year increased electric rates proposed by St. Joseph Power & Light Co . . . **George H. Flagg,** Oregon Public Utilities Commissioner, has dismissed an application of the California-Oregon Power Co for general increase in its rates.

Electric Utility Financing

Company	Description	(000) Amount of Offering	Price Offering	Public Yield at Price to
	WEEK OF OCTOBER 11-17			
Bonds				
Nashville, Tenn.	electric revenues, 1954-1981	$3,500	various	1.20-2.19%*
New England Gas & Electric Association	coll tr, 4% 1971 new money	6,115	101%	3.93
Common Stock				
Central & South West	500,000 sh, new money	7,420	$15.175	5.93
Louisville Gas & Electric	130,000 sh, new money	4,355	33.50	5.37
	WEEK OF OCTOBER 18-24			
Bonds				
Wisconsin-Michigan Power	1st mtg	$3,500	.....	.....
Preferred Stock				
Pacific Gas & Electric	1.5 million, 1st pfd, $25 par	37,500	.....	.....
Common Stock				
Public Service of Indiana	324,656 (1-for-10, record Oct. 8, $28.125)	9,131	.....	.....
	SCHEDULED OCTOBER-NOVEMBER-DECEMBER			
Bonds				Bid Date
Utah Power & Light	1st mtg	$9,000		Oct. 29
Ohio Power	1st mtg	15,000		Oct. 30
Ohio Power	serial notes	7,000		Oct. 30
West Texas Utilities	1st mtg	8,000		Oct. 30
Rockland Light & Power	1st mtg	6,000		Nov. 7
Florida Power & Light	1st mtg	10,000		Nov. 14
Gulf States Utilities	1st mtg	10,000		Nov. 20
Virginia Electric & Power	1st mtg	20,000		Dec. 20
Preferred Stock				
Long Island Lighting	100,000 sh, $100 par	$10,000		Nov. 7
Commonwealth Edison	1,716,500 sh, cum conv, $25 par (to common holders in ration of 1 sh pfd for each 8 common sh held, record Oct. 30)	42,913	.....	.....
Common Stock				
Consumers Power	561,517 sh (1-for-10, record Oct. 17, $32)	.....	.....	$18,000
Long Island Lighting	524,949 (1-for-7, record Oct. 24)	.....	.....	Nov. 8**
	UNSCHEDULED—UNDER CONSIDERATION			
Bonds				
Central Louisiana Electric	debs, 1971	$4,000		.....

* Approximate
** Expiration date

Wilson Asked to Study Power Sites in Alaska

Two sites in Alaska can produce almost 2 million kw of power, the Alaska Development Board has advised Charles E. Wilson, defense mobilizer, in asking him to investigate development of electric power in the territory for the aluminum industry.

The sites, the Taiya Project and Copper River Valley in southeastern Alaska, have "complete natural protection from possible attack, yet are readily accessible to ocean navigation," the board declared.

The Aluminum Co of America has declared it is studying possible Alaska development, although no immediate moves are in prospect.

The proposed Alaska projects would be similar to the $500-million Kitimat Project now being developed by the Aluminum Co of Canada in northern British Columbia.

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Brazos Project to Begin

The Brazos River (Tex.) Project, which caused a dispute last year between federal and state agencies, is finally getting underway. The Housing and Home Finance Agency has approved an interest-free advance of $307,500 to Brazos River Conservation and Reclamation District for planning of four dams and power houses.

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Receives Palladium Medal

Dr Carl Wagner, visiting professor of metallurgy, Massachusetts Institute of Technology, has received the first Palladium Medal Award of the Electrochemical Society.

Output Week Ended Oct. 13—7,160,380,000 Kwhr

Weekly Output, Millions Kwhr

1951		1950		1949	
Oct 13	7,160	Oct 14	6,509	Oct 15	5,481
Oct 6	7,156	Oct 7	6,514	Oct 8	5,450
Sept 29	7,102	Sept 30	6,503	Oct 1	5,521
Sept 22	7,014	Sept 23	6,457	Sept 24	5,556
Sept 15	7,138	Sept 16	6,449	Sept 17	5,579
Sept 8	6,795	Sept 9	6,029	Sept 10	5,258
Sept 1	7,146	Sept 2	6,459	Sept 3	5,544
Aug 25	7,077	Aug 26	6,346	Aug 27	5,523
Aug 18	7,164	Aug 17	6,370	Aug 16	5,579
Aug 11	7,070	Aug 12	6,253	Aug 13	5,530

Per Cent Change from Previous Year

	Oct 13	Oct 6	Sept 29
New England	+ 3.1	+ 5.1	+ 1.6
Mid-Atlantic	+ 7.6	+ 8.7	+ 6.7
Central Industrial	+ 6.5	+ 6.2	+ 5.7
West Central	+12.0	+10.7	+11.6
Southeast	+13.4	+12.0	+13.2
South Central	+21.9	+26.5	+24.4
Rocky Mountain	+ 9.7	+10.5	+11.2
Pacific Coast	+12.0	+ 8.9	+ 8.1
Total United States	+10.0	+ 9.9	+ 9.2

MEETINGS

Public Utilities Advertising Association
Region 7 Meeting, Edgewater Hotel, Madison, Wis., October 22-23; Region 2 Meeting, Advertising Club of New York, New York, N. Y., December 7.

Pennsylvania Electric Association
Electrical Equipment Committee, Penn Alto Hotel, Altoona, Pa., October 22-23; Meter Committee, Arlington Hotel, Oil City, Pa., October 25-26; Prime Movers Committee, Fort Stanwix Hotel, Johnstown, Pa., November 1-2; Systems Operation Committee, Split Rock Lodge, Split Rock, Pa., November 8-9.

National Electronics Conference
Annual Conference, Edgewater Beach Hotel, Chicago, Ill., October 22-24.

American Standards Association
Annual Meeting, Waldorf-Astoria, New York, October 22-24.

University of Texas
Power Distribution Conference, Lower Colorado River Authority Auditorium, Austin, Tex., October 22-24.

American Institute of Electrical Engineers
Fall General Meeting, Hotel Cleveland, Cleveland, Ohio, October 22-26.

Southeastern Electric Exchange
Sales Conference, Roosevelt Hotel, New Orleans, La., October 31, November 1-2.

Electrical Inspectors' Association of British Columbia
Annual Conference, Hotel Georgia, Vancouver, B. C., November 2-3.

★**Texas A. and M. College**
Public Utility Short Course for Electrical Metermen, College Station, Tex., November 5-9.

Northwest Public Power Association
Accounting Section, Governor Hotel, Olympia, Wash., November 8-9.

National Electrical Manufacturers Association
Chalfonte-Haddon Hall, Atlantic City, N. J., November 12-15.

California Municipal Utilities Association
Annual Conference, Hotel Leamington, Oakland, Calif., November 13-16.

Wisconsin Utilities Association
Electric-Gas Sections, Sales-Engineering Divisions, Schroeder Hotel, Milwaukee, Wis., November 14-16.

★**Instrument Society of America**
Boiler Instrumentation Symposium, Bellevue-Stratford Hotel, Philadelphia, Pa., November 15.

New Jersey Utilities Association
Annual Meeting, Seaview Country Club, Absecon, N. J., November 15-17.

American Society of Mechanical Engineers
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., November 26-30.

★**Westinghouse Electric Corporation**
4-H Farm-Home Electric Program Conference, Hotel Stevens, Chicago, Ill., November 28.

Pacific Coast Electrical Association
Annual Hawaiian Conference, Royal Hawaiian Hotel, Honolulu, T. H., November 29-30.

★**American Institute of Electrical Engineers**
Technical Conference, Chalfonte-Haddon Hall, Atlantic City, N. J., December 6-7.

★Addition this week.

WASHINGTON COMMENT

JESSE MOCK

"Do-ability" is a word that is catching on fast among the defense planners in Washington. Roughly defined, it appears to mean "capable of attainment." For instance, in studying production programs the planners must not only consider the need but must consider also whether a specific production goal is "capable of attainment"—whether it has "do-ability."

It is within this "do-ability" framework that the committee has been set up to review the expansion program of the electric power industry. For nearly six months the industry has been working toward the stated goal of adding 27 million kw generating capacity to the nation's power systems during the three years, 1951-53.

Industry Program Losing "Do-Ability"

Because of the tight materials situation it has become evident that the industry has not been able to keep to its schedule. To the planners, the 27 million-kw program is slipping out of the "do-ability" range.

The committee was set up as the one means of bringing the program back into range. Defense Production Administrator Manly Fleischmann, who must take a chance now and then, would be pleased to have the committee recommend an expansion program more in line with the materials available. Such a report would take some of the heat off Fleischmann who is charged with divvying up the available materials.

However, as far as can be determined, he has not instructed the committee to go out and see where the program can be cut. Rather, he has asked the members to study power needs and recommend the size program needed to meet them.

The DPA chief has left himself only one "out." He has made it clear that the committee is purely advisory. He will consider the recommendations but will not necessarily be bound by them.

Committee's Report May "Stick" Fleischmann

All things considered, this appears to be pretty thin ice on which to skate. The members of the committee are highly respected in the segments of the industry and government with which they are associated. Their opinion is bound to carry weight. Although their report may be submitted confidentially, its contents are almost certain to leak out sooner or later.

When this happens, Fleischmann will be stuck with it, whether he agrees with it or not. Should the report recommend a program substantially the same as the one now in existence, Fleischmann may well find that his efforts to attain "do-ability" in regard to the program have backfired.

Among those who are in a position to evaluate the present program, there seems little margin for cutting.

Defense Electric Power Administration, author of the 27 million-kw program, clearly believes it is a realistic one. In a recent speech Clifford Beardsley, who heads Depa's Power Requirements Branch, answered charges that the agency's forecast of load and capacity forecasts are too high:

"We can assure you that there is no desire, or reason to desire, to add one single kilowatt of capacity more than is necessary for safe operation."

There are two ways to obtain the "do-ability" for which Fleischmann is looking. One is to scale down program goals. The other is to provide sufficient materials to attain those goals. In grasping for the first alternative, he may find himself stuck more firmly with the second.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Pressurized operation of boilers may contribute even more to station net thermal efficiency than did the adoption of reheat.

Storage battery grids of lead containing 0.1% calcium showed only 4% drop in capacity per month on standby service; those with grids containing 12% of antimony showed 20% drop.

Electricity and gas were corporate bedfellows, in a way, at the beginning; William Murdoch, who first distilled gas from coal in 1792 worked for Boulton & Watt—the James Watt of steam-power fame.

Penstocks painting with three coats of black for gain in head can be done more conscientiously if the middle coat carries aluminum powder for contrast with the first and last.

Phosphoric acid will not only remove light rust but will inhibit somewhat against resumed rusting because it leaves an iron-phosphate coating.

Transmission losses can more than waste the gains achieved in modern high-efficiency generating stations; electric computers should afford the answer.

Plastic-insulated cables should not be lubricated with petroleum products for pulling purposes; a soft sodium soap is less deleterious but this in turn should not be applied to lead-sheathed cables.

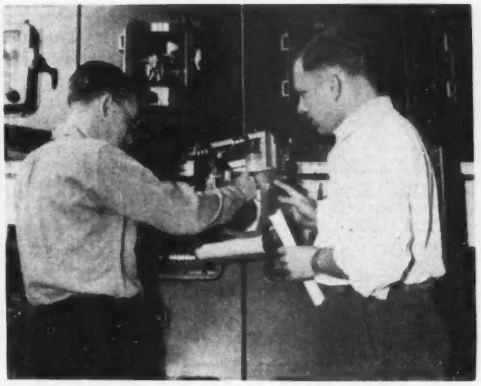
Static friction is minimized with lubricants containing molybdenum disulphide, mineral grease, the dry molybdenum disulphide alone, and a fluorinated hydro-carbon with graphite additive.

Centrifugal forces on coils and wedges of large turbo-generator rotors may reach values of 4,000 to 6,000 times their weight; from the rotor-heating standpoint, line-to-line faults are more severe; in the stator, electromagnetic considerations predominate.

Permissible duration of generator faults is influenced by the amount of excitation and the size of the connected system; lesser values of either permit longer durations.

GRADUATE-ENGINEER TRAINEE of Test Branch maintains carrier current equipment while field test engineer watches

POLYPHASE VECTORS are discussed as part of formal classroom instruction given young graduate engineers



TWO ENGINEER TRAINEES look for trouble in some carrier current equipment at one of TVA's stations

How TVA Trains Its Engineers

Classroom instruction provided during working hours. Extensive home study required. Stiff examinations and careful rotation of job assignments round out TVA's training program for engineers

C. A. DUKE, Chief, and H. B. CUMMINGS, JR, Office Engineer
Electrical Laboratory and Test Branch
Tennessee Valley Authority, Chattanooga

At one time the Division of Power Operations of Tennessee Valley Authority filled its numerous engineering and operating positions by employing experienced engineers or by hiring young engineering graduates and depending upon them to absorb the necessary knowledge and experience as a by-product of their regular work assignments. But this method of training proved inadequate to meet the needs of the rapidly expanding system. It became necessary to develop a division-wide training program. In cooperation with the employees, through joint employee-management committees, a training program was worked out in detail and was placed in operation on July 1, 1947.

Basic features of the program are similar for all branches of the division. Each branch develops its own training schedule and is responsible for the administration of its portion of the program. The program of the Electrical Laboratory and Test Branch is a major phase and is representative of the whole program.

First, specialized engineering instruction directly related to the work program is provided within working hours by TVA personnel. Second, rotating work assignments are carefully

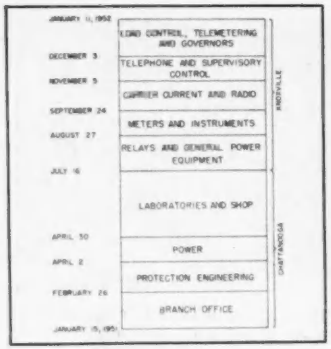


FIG 1—ROTATING ASSIGNMENTS for a hypothetical trainee indicate nature of training and time devoted to subjects

TENNESSEE VALLEY AUTHORITY
1. ATTITUDE FOR THIS KIND OF WORK
2. ATTITUDE TOWARD HIS WORK
3. ATTITUDE TOWARD HIS ASSOCIATES
4. THE INITIATIVE HE SHOWS IN THIS TYPE OF WORK
5. MENTAL ALERTNESS AND JUDGMENT
6. GRASP OF ESSENTIAL TECHNICAL INFORMATION
7. CHARACTER AND INTEGRITY
8. PERSONALITY
9. PHYSICAL STAMINA
10. SAFETY-MINDEDNESS
REMARKS:
SUPERVISOR

FIG 2—RATING FORMS, filled in by supervisor at end of each assignment, are guide to future training

ASSIGNMENT	SUPERVISOR	DATE	APTITUDE	ATTITUDE		INITIATIVE	ALERTNESS AND JUDGMENT	GRASP OF INFORMATION	CHARACTER AND INTEGRITY	PERSONALITY	PHYSICAL STAMINA	SAFETY MINDEDNESS
				WORK	ASSOCIATE							
RELAYS AND GENERAL	A.B. Lee	7/48	S-2	S-2	S-2	S-2	S-2	S-2	S-2	S-2	S-2	S-2
LABORATORIES AND SHOP	J.R. Bell	3/48	S-2	S-2	S-2	S-1	S-1	S-2	S-1	S-1	S-1	S-1
LOAD CONTROL AND TELEMETERING	L.C. Trent	5/48	S-2	S-2	S-2	S-2	S-2	S-2	S-1	S-1	S-1	S-2
CARRIER CURRENT	K.C. Trent	8/48	S-2	S-2	S-2	S-3	S-2	S-2	S-2	S-2	S-2	S-2
BRANCH OFFICE	K.K. Branch	9/47	S-1	S-1	S-1	S-1	S-2	S-2	S-1	S-1	S-1	S-2
COMMUNICATION	J.J. Fell	12/47	S-2	S-2	S-2	S-2	S-2	S-1	S-1	E	S-2	S-2
METERING	O.T. Bell	5/48	S-2	S-2	S-1	S-2	S-2	S-1	S-2	S-2	S-2	S-2
PROTECTION ENGINEERING	B.A. Chain	9/48	S-2	S-2	S-2	S-2	S-2	S-2	S-2	S-2	S-2	S-2
FIELD ASSIGNMENT	N.D. Field	6/49	S-2	S-2	S-1	S-2	S-2	S-1	S-2	S-2	S-2	S-2

FIG 3—COMPOSITE PICTURE of supervisors' ratings and performance in work assignments is assembled on back of each trainee's personal-record card

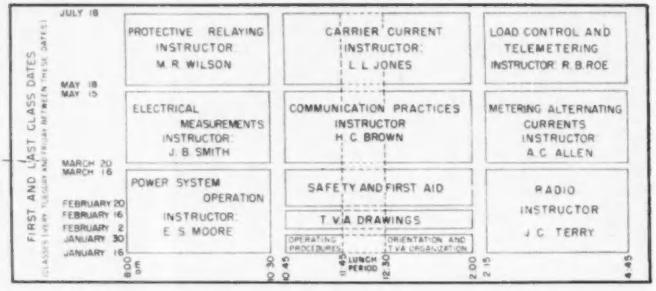


FIG 4—CLASS SCHEDULES are worked out carefully, and this chart shows typical program. Courses are scheduled in groups of three, for periods of 17 or 18 weeks. Three 2½ hr classes meet twice a week, Tuesday and Friday

selected and scheduled to provide the required experience with all types of equipment used in both power and communication applications. These activities comprise half the period of internship. The other half of the period is devoted to specialized training with these types of equipment.

Organization . . . The detailed operation of the program is supervised by the Office Engineer of the branch. A training committee periodically reviews the progress of participants, examines the results as evidence is accumulated, and considers improvements. This committee has one member from management and one representing the TVA Engineers Association, both with equal voice. A third member, representing the Division of Personnel, serves as secretary. This committee reports to another committee of similar composition, which follows training activities of the entire Division of Power Operations.

Selection and Recruitment . . . At the time of recruitment, candidates are familiarized with the training program and with the general nature of the employment. All those who are not definitely attracted by such a program are eliminated in the beginning. This familiarization is accomplished, in part, by having a member of the engineering staff of the branch accompany representatives of the Division of Personnel to various colleges.

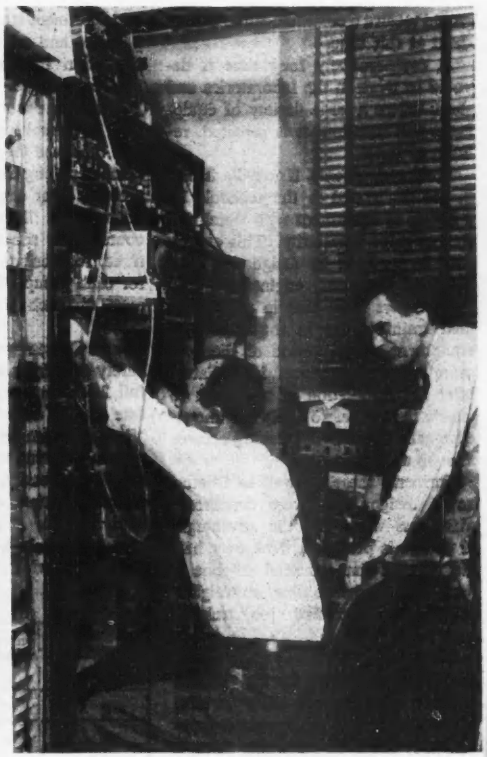
In a "get-acquainted" period, covering each new employee's first few days, he is introduced to all central administrative and engineering personnel. Tours are arranged through a nearby hydroelectric plant and the laboratories. Assistance is given in the location of living quarters, and the employee is invited to become affiliated with the local sections of the AIEE and the TVA Engineers Association.

Formal classes are then organized to further the employee's orientation. These classes are scheduled along with engineering classes. Ten 2½-hr sessions are allotted to Orientation and TVA Organization, Operating Procedures, and TVA Drawings.

Experience has demonstrated that an orientation period with the equipment is of inestimable value. Therefore, a portion of the one year of specialized field training is scheduled at the beginning. This portion varies but ranges from three to six months.

In this period the trainee is assigned as a helper to a competent field-test engineer or a group of field-test engineers whose responsibilities embrace the specialized field for which he is being trained. Experience is provided with as great a variety of equip-

FIELD TEST ENGINEER of TVA's electrical laboratory and test branch pauses to explain the operation of an automatic oscillograph installation to the engineer trainee assigned to him



TRAINEE TRIES HIS HAND at adjusting load recorder at Chickamauga plant as field test engineer looks on. Experienced engineer remains on hand to see job is done correctly

ment as possible. Development of proficiency is given only secondary consideration. Occasionally the trainee is assigned work with equipment not in his own field.

Diversified Field Experience . . . On casual inspection this plan might appear to be the usual training by diversification. However, the very substance of the plan is to attempt to develop engineers with varied abilities and experience. Consequently, more thought and effort are given to this part of the program than to any other. Throughout the course of this period the trainee is under the direct supervision of the co-ordinator of training activities who arranges his schedule of assignments and maintains intimate contact with him at all times. By this means and through consultation with immediate supervisors the co-ordinator is able to vary individual assignments and avoid clashes of personality. The variety of work assignments enables the trainee and the coordinator to form a fairly accurate estimate of the trainee's intrinsic abilities and, consequently, the optimum field for ultimate specialization.

A typical schedule of rotating assignments for a hypothetical trainee with a power major is shown in Fig. 1. Notice that this schedule covers one year, half of the two-year training program. For six months of this period the trainee is located in Chattanooga, where classroom instruction is provided. The remaining six months are spent at any one of several locations at which all the assignments indicated can be made.

Throughout the first six months, while all the trainees of any one group are located in Chattanooga, two full days each week are allotted to classroom instruction, allowing only three days a week for the assignments shown. Assignments shown for Knoxville cover the full work week. Consequently, the Chattanooga assignments are relatively longer than they would be otherwise.

The period spent in the branch office enlarges the trainee's acquaintance with the personnel and problems of the technical staff. Here he acquires first-hand knowledge of the reasons for certain requirements for field reports, which often seem unnecessary to the field man. A few weeks spent in the Relay and Protection Engineering Section of the Power System Operations Branch permit an insight into engineering studies. The principal reason for the power assignment in the course at Chattanooga is to broaden the trainee's acquaintance with the power system and facilities and with the personnel of the branch. A man in training for communication work

would receive a communication assignment at this time.

A comparatively long time is devoted to work in the laboratories and shop, where a large variety of equipment and instruments is repaired, rebuilt, or tested.

Field assignments, Knoxville in Fig 1, are designated in the schedule by a listing of equipment with which the trainee gains familiarity. This experience is provided by assignment with qualified field-test engineers. The work differs from that in specialized field training only in the variety of equipment. This portion of the program is purposely placed immediately after the completion of classwork to enable the trainee to apply the knowledge gained in the engineering courses as soon as practicable.

Formerly these, as well as Chattanooga assignments, were concurrent with class work, but the advantages of two class periods a week over half the elapsed time, instead of one a week over the entire time, outweighed having all diversified job training parallel instruction.

Dummy circuits, using spare equipment, have been set up for practice "trouble shooting" in slack periods. Discussion groups are organized spontaneously when time permits. Also, a freedom for questioning has been fostered by the full cooperation of test engineers.

The rating form, Fig 2, is filled in by the trainee's immediate supervisor at the conclusion of each assignment. After some assignments, composite ratings of two or more test engineers are used to reflect the performance of the trainee while working with each. To this multiplicity of ratings are added quarterly reports on the same form submitted by supervisors in the specialized portion of the program.

So that a composite picture might be easily obtained, these ratings are assembled on the back of a personal-record card, as illustrated in Fig 3. The symbols used on this card are the same as those indicated in Fig 2. "S-1," "S-2," and "S-3" mean "satisfactory and above average," "average," and "below average," respectively. Only the final of the quarterly reports submitted in the specialized period is recorded on this card. The other side of the card contains the student's grades and over-all evaluation by his instructors in the classes and pertinent facts of previous experience and college record. This information for an imaginary trainee is given in Fig 6.

Through devoting scheduled work time to formal instruction, much time can be saved in the development of competent engineering personnel. At present, eight engineering courses are offered. As illustrated in Fig 4, the courses are scheduled in groups of three, for periods of 17 or 18 weeks for each group. Three 2½-hr classes meet on each Tuesday and Friday.

Course Content and Text Material . . . Safety and first-aid classes comprise a full 20-hr course leading to a certificate in first aid. The course entitled "Power System Operation" is a survey course, covering the subject of its title fully but broadly. Essentially this is a lecture course, and no formal textbook is used. A great deal of reference reading, however, is required.

It is a preview, so to speak, of the interrelation and the interdependence of the equipment studied in all the other courses. It provides an introduction for most of the students to many of the automatic control schemes used in modern systems.

A course in electronics and radio takes advantage of the background of the students and provides a comprehensive coverage of these subjects. In addition, some time is devoted to preparing the students for an examination equivalent to that for a commercial radio operator's license.

The two courses "Electrical Measurements" and "Metering Alternating Currents" are based largely on college textbooks, although considerable supplementary material, written by staff engineers, has been added to the course in metering.

This metering course differs considerably from one which might be taught in college or by some other utility because TVA is entirely a wholesale distributor of electricity.

NAME	ELECTRICAL MEASUREMENTS	COMMUNICATION PRACTICES	METERING ALTERNATING CURRENTS	LOAD CONTROL AND TELEMETERING	CARRIER CURRENT	PROTECTIVE RELAYING
1	C	B	B	B	B	B
2	C	B	B	B	B	C
3	B	A	B	B	A	B
4	B	B	B	B	B	A
5	A	A	B	A	A	A
6	C	B	C	B	C	C
7	C	B	C	B	C	B
8	C	B	B	B	B	A
9	B	C	C	B	B	C

FIG 5—STUDENTS ARE GRADED on all classroom work, and grades for one group of nine anonymous "students" are shown here for the six courses they completed

NAME: John A. Doe — TITLE AND GRADE: E.E. Trainee I — COLLEGE RECORD: 1.2 of 4
ADDRESS: 243 Grand Ave, Chattanooga — VETERAN: yes — MARRIED: yes — CHILDREN: 1
PHONE: 76-5962 — DATE OF BIRTH: 7-23-28 — SCHOOL: Auburn — COURSE: Power

SUBJECT	INSTRUCTOR	TEST AVERAGE		DATE	INTELLIGENCE IN CLASSWORK	INITIATIVE	ATTITUDE	CHARACTER AND INTEGRITY	PERSONAL APPEARANCE	REMARKS
ELECTRICAL MEASUREMENTS	J.B. Smith	78	C	4/48	S-1	S-2	S-1	S-1	S-1	
COMMUNICATION PRACTICES	H.C. Brown	66	D	2/48	S-2	S-2	S-2	S-2	S-2	Grade satisfactory because this is not one of his major courses
METERING ALTERNATING CURRENTS	A.C. Allen	74	C	4/48	S-2	S-2	S-1	S-1	S-2	
LOAD CONTROL AND TELEMETERING	R.B. Roe	72	C	4/48	S-2	S-2	S-2	S-2	S-2	
CARRIER-CURRENT AND RADIO EQUIPMENT	L.L. Jones	74	C	4/48	S-2	S-2	S-1	S-2	S-2	
PROTECTIVE RELAYING	Clarence MacKinney	86	B	May 4/48	S-3	S-2	S-2	S-2	S-2	Make up work was required in this course because of the sickness

FIG 6—CLASS RECORDS for each trainee are kept and recorded on front side of permanent personal-record card, which shows grades and instructors' ratings

Communication Practices . . . In a course in telephony and supervisory control both manual and automatic telephone installations are studied. Considerable time is given to protection and inductive coordination. Several types of remote-control equipment are included. Text for the course has been assembled from bulletins and instruction books published by the manufacturers of the equipment used. These have been blended into a fairly continuous development by writings of staff and field-test engineers.

Because growth of the TVA power system has taken place within the past decade, most of the equipment covered by the last three courses are ultramodern. No textbook could be found which adequately covered any one of these subjects for our purpose. Fortunately, considerable material had been written or assembled by staff engineers in the preparation of a series of field test manuals. A portion of these books consists of a technical description, in textbook form, of the theory of application and operation of the equipment studied.

Instructors . . . Use of staff-prepared manuals for textbooks provides thorough practical instruction because only pertinent material is included. The practical viewpoint is accentuated by the selection of instructors from thoroughly qualified engineers who have had years of experience. All classwork is maintained on an informal basis, and frequent classroom discussions on a fellow-worker basis between instructor and student bring out ideas that would be lost in a more pedagogical arrangement.

Grading System . . . Evaluation is based entirely on comprehensive objective examinations comparable in difficulty to those in colleges. Two tests, each from two to five hours long, are required for each course. These tests have now been standardized as to form, length, and context although the actual questions are varied from year to year. Standardization was accomplished through adjustment of the number and difficulty of the questions after experimental grading "on the curve." Definite minimum requirements have been set up. Grading has been established on the conventional A, B, C, D, and F basis, wherein D is conditional passing and F denotes failure. A man who receives F in any course is dropped from the program.

Figure 5 shows the actual grades made by one group of students in six of these courses. Figure 6 shows the side of the personal-record card, on which class records are kept.

Specialized Training . . . After the diversified training there is a period of training of a more specific nature. To develop men principally as field-test engineers, their continued training is similar to that received in rotation field assignments but confined to a smaller group of equipment. For this purpose the equipment listed in the field assignments in Fig 1 is divided into three groups. Special recorders, load control and telemetering equipment, and governors are classified as communication equipment and are combined with carrier current equipment and radio for one category. Telephone, teletype, and supervisory control equipment is also combined with carrier current equipment for a second communication category. All strictly power equipment forms the third.

The category for each trainee is confirmed when he reaches this point in the program. The employee is located during this final period in the area which is to be his permanent location. In this way he becomes acquainted with the personnel and the specific equipment of the area as a part of his training. Although by this time he is quite capable of considerable independent work, he is again assigned to a test engineer in the position of helper.

The pattern of activities is not left to chance. Through a weekly report submitted by each trainee, an accurate record is kept throughout the program of the actual number of hours of experience he has gained with each type of equipment. Periodically these records are studied by the co-ordinator of the training program, and appropriate recommendations are made to supervisors. In this manner certain minimum requirements are met with regard to the experience each man must gain with the more important types of equipment.

Correspondence Courses . . . Some successful use of correspondence courses for training purposes has already been accomplished. Five courses of this type have been prepared, others are in preparation, and still others are planned for the future. Those already in use or planned for the immediate future, however, parallel the courses which are provided in the training program. They are intended for older men whose work has been specialized and who might wish to acquire a basic knowledge of other electric equipment related to their work. It is planned in the future to allow older men who have demonstrated a desire and propensity for expanding their spheres of operations to acquire experience with the equipment studied in correspondence courses. The real purpose of this type of training is to enable men who have already proved themselves as test engineers to acquire the additional knowledge and experience required of area supervisors. For this reason it is called "upgrade" training. Thus, the older men do not have to sacrifice the obvious advantages of their seniority and greater specialized experience because of the lack of general knowledge and experience, which are given to all new employees through the training program now being followed.

Conclusions . . . That the training program does produce qualified test engineers can no longer be questioned in spite of the fact that only a comparative few have so far completed it. Section supervisors, who have the responsibility of several areas, are pleased with the added flexibility the new men bring to their work. The experience of the section supervisors seems to indicate that it is not necessary to divide communication men into two classifications since the few who have completed their training are now being used indiscriminately on all kinds of communication equipment and, to a lesser extent, even on power equipment. Conversely, power men have demonstrated their ability to handle minor communication troubles.

Three groups of new employees have completed their training and have been promoted to full field-test status. Out of a total of 69 men enrolled through August 1, 1950, one has been dropped from the program because of failure to meet the standards, four have resigned to accept other employment, and one has returned to school.

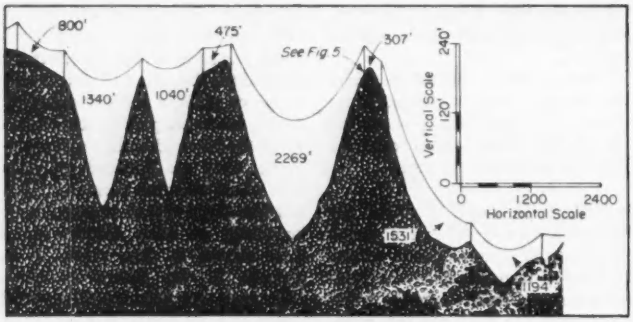


FIG 1—Coulees were spanned in some sections of line where distances were not too great and field conditions permitted use of a single span

Special Structures Cross Rugged Terrain

Spans up to 2,269 ft long cross coulees. Many structures had to be specially designed for side hills, bluff tops, extra long spans, and to meet other unusual problems. Details are described here

F. W. LINDER, Chief Electrical Engineer
Dairyland Power Cooperative, LaCrosse, Wisconsin

Severe conditions for 32.2 miles of the distance along the east bank of the Mississippi River between the Alma and Genoa generating stations resulted in an H-frame 138-kv transmission line with some unusual structure designs. Bluffs approximately 500 ft above the river elevation are cut by coulees which range from 1,000 ft to over one mile in width. In most instances structures were set on the bluff and coulees were spanned as shown in the profile, Fig 1. In some instances it was more economical to install intervening structures, Fig 2.

Phase conductors are 336,400 cir mil, 26/7 ACSR. Shield wires are ⅜-in. high strength steel strand. Basic tangent structures provide for 15-ft poles and 15-ft spacing. Crossarms are double, 3¾ x 8¾-in. by 31 ft. Douglas fir timbers with metal spacer fittings which support the insulator string. The structure is rigidly braced with 3⅜ in. by 5⅜ in. Douglas fir X-braces and 3⅜ in. by 4⅜ in. Douglas fir V-braces.

Angle and Dead End Structures . . . Three-pole structures were used for angles and dead ends. Combinations of single and double ⅜-in. high strength steel guys were installed, with pole bands for attaching guys to poles.

Full advantage was taken of terrain, using long spans wherever feasible. There are 36 spans over 1,200 ft in length and 13 spans over 1,500 ft in length. The longest span is 2,269 ft. On one section of 1.5 mi of line, the average span is 1,317 ft, or an average of four structures per mile. The total line averaged 6.9 structures per mile.

Special Long Span Structures . . . Standard 15-ft phase spacing was not considered adequate for spans in excess of 1,500 ft and special long span four-pole structures with a 20-ft phase spacing were designed. This structure provides adequate conductor separation for spans up to 2,500 ft. On steep side hills, where several of these structures were installed, the phase on the down hill side was lowered because of the long pole required to place all three phases at the same level.

110-Ft Wood Structures . . . Where the 138-kv line crossed three 69-kv lines at the Alma Station a three-pole angle deadend (see Fig 3) was required. Used in this type structure were 100-ft, 105-ft, and 110-ft Class 1 poles; 69-kv lines are on 60 and 65-ft Class 2 poles. Top of bluff (Fig 3) is 470 ft above point where the picture was taken. Medium angles were handled on three-pole structures.

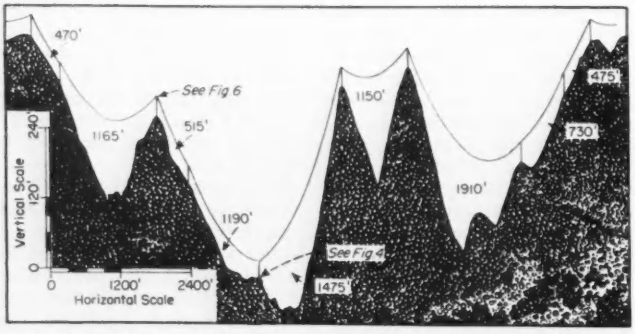


FIG 2—SOME WIDE COULEES were not spanned because conductor and structure designs for the purpose were less economical than additional structures

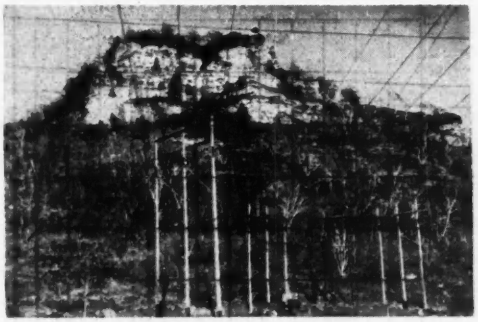


FIG 3—THREE-POLE ANGLE DEADEND with 110-ft poles was installed for crossing three 69-kv lines near the Alma Station

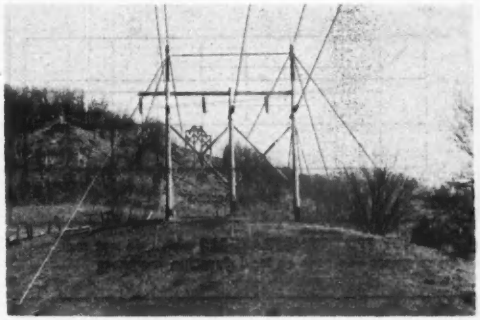


FIG 4—THREE-POLE STRUCTURES for angles and deadends were utilized where strength and spacing were required

Prevent Structure Overturn . . . Experience indicated that special attention should be given to preventing structures from pulling out of the ground and turning over under heavy transverse load caused by long spans between sections. An analytical method was developed to determine which structures should have additional anchoring to prevent pull-out. This method was based on curves developed in a study and tests made by the Central Nebraska Public Power and Irrigation District. Using this data the forces of earth resisting uplift on Class 3 poles in an X-braced H-frame structure under normal conditions were determined for various types of soil. For each class larger than 3 the force resisting uplift is approximately 3% greater than for Class 3 poles, and 3% less for each pole size smaller than Class 3.

It was necessary to predetermine the type of earth before the line was designed because in most areas there were several different types of earth and the earth could not be classified until the holes were dug. Therefore, the types of earth were listed in the order of their resisting force against uplift and given a classification number. When the structures were spotted on the plan and profile sheets in the office, the type of earth was determined for each structure which would have the minimum allowable resisting force against uplift. The type of earth thus determined was called the design earth type. If, when the holes were dug, it was determined that the actual earth was of a type having less resisting force against uplift than the design earth type, additional anchoring was installed on the structure.

VITAL STATISTICS

Dairyland Power Cooperative
La Crosse, Wisc.
Data as of Jan 1, 1950

Transmission Line—Miles	1,695
REA Borrowers Served	25
Consumers Served	76,767
Plant Capacity—Total Kw	53,700
Steam—Kw	44,000
Internal Combustion — Kw	9,200
Hydro—Kw	500
Kwhr Generated	276,025,525

Methods for obtaining the necessary pole anchoring were; setting poles deeper, installing concrete pole anchors, backfilling holes with sharp crushed rock, adding bog shoes and installing side guys. The concrete pole anchors and bogshoes were also used on angle and deadend structures to keep the structure bearing pressure below recommended standard allowable values.

Construction Methods . . . To insure that X-braces would be installed on the structure at the correct location, a special template calibrated in feet and also in structure type and pole length was used for measuring down from the crossarm to the top hole location for the X-brace.

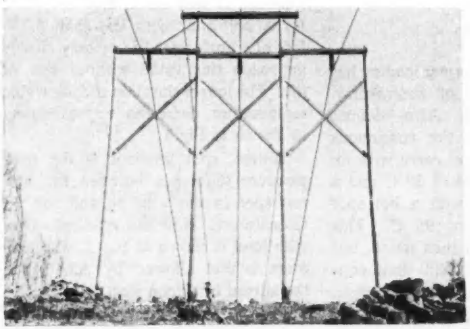


FIG 5—SPANS OVER 1500 FT long were supported by four-pole structures designed for 20-ft phase spacing

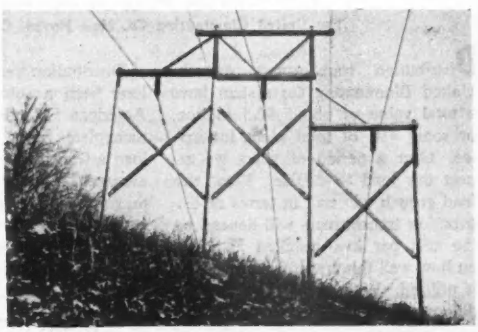


FIG 6—ON STEEP SIDE HILLS the phase on the down hill side was lowered, eliminating the need for an extra tall pole

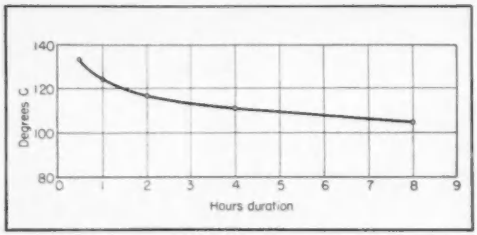


FIG 1—HOT SPOT TEMPERATURES which do not reduce life of transformer decrease as load duration increases

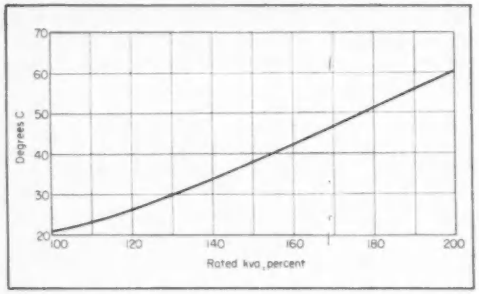


FIG 2—HOTTEST SPOT GRADIENT above top oil temperature, as allowed by ASA, is based on use of silicon steels

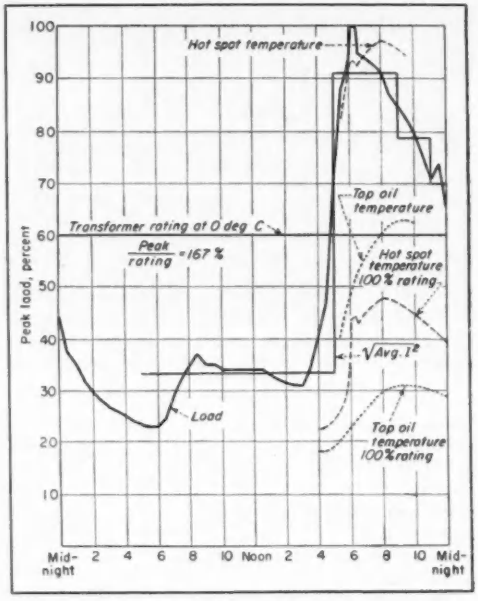


FIG 3—RESIDENTIAL LOAD on Christmas Eve was basis for study to determine required transformer capacity

Heavier Transformer Loading Is Feasible

If system load doubles, $500,000 may be saved by 10% difference in utilization of distribution transformers. Extended analyses indicate economic benefits of working transformers harder

A. F. SEDGWICK, Engineering Department
The United Illuminating Co, New Haven, Conn.

Distribution transformers on the United Illuminating Co system have a total value of about $2.5 million, or some 4% of total plant in service. Over a period of years we expect our load to double. What this load growth will cost in terms of distribution transformers will depend on the cost per kva installed and also on how well this transformer capacity is utilized. With double load a 10% difference in transformer utilization may represent a capital saving of $500,000, a sizeable sum.

Distribution transformer loading has long been a subject of controversy. American Standards Assn defines nameplate rating as the continuous load a transformer will carry with an average 24-hr ambient of 30 C and a maximum of 40 C, with a hot spot copper temperature of 95 C. This rating is simple when thus stated, but our loads hardly ever fulfill these conditions.

Many Variables . . . The hot spot limit given above is higher for intermittent loading. It may go as high as 132 C for a half-hour with less than 0.1% loss of transformer life or may closely approach this value without loss of life. For longer duration the allowable temperature decreases approximately as shown in Fig 1.

Hottest spot gradient is the temperature difference between the hottest spot in the winding and top oil temperature. How this gradient varies with load is shown in Fig 2. The gradient is that allowed by ASA since the advent of silicon steel.

Top oil temperature is that of the hottest oil. It rises from a lower value until the temperature difference be-

tween oil and surrounding air suffices to dissipate the heat generated in the transformer. Top oil temperature is limited by the allowable hot spot temperature less the hot spot gradient.

Design ambient of 30 C average for 24 hr is a normal summer temperature. Below 30 C, heat is carried away readily from the unit. Such temperatures increase higher load carrying ability without overheating.

The foregoing variables, as functions of time, load, and temperature, may appear simultaneously. Each affects transformer load capability. We ignore ratings of generators and load them by temperature, but why not transformers?

Effects of Variables . . . Examining the effect of these variables independently as recommended by ASA, it appears that for each degree C below 30 C the transformer can carry 1% more load up to a limit of 30%. For each 1% decrease in load factor from 100% the capacity can be increased by ½% up to 25%. Both these variables can be applied simultaneously. Thus a transformer with 50% load factor at 0 C can carry 25% plus 30% over its rating, or 155% rating. These increases are conservative, but when all variables are considered, loads of 220% may be carried safely under certain conditions.

A typical load curve in a conservative well-established residential area is shown in Fig 3. To obtain the transformer rating required to carry this load cycle at 0 C, curves were used as developed by F. Beavers, General Electric Co.* A block load was assumed which has the $\sqrt{\text{avg}I^2}$ of the actual load. Transformer size was found to be 60% of the load, ie, the transformer could carry 167% of rating. As a check, top oil temperature and hot spot temperature were plotted using curves developed by R. C. Cheek, Westinghouse Electric Corp.** Hot spot temperature reached 98 C, close to the continuous 95 C limit, but the short duration enabled the loading to be increased. By recalculating the problem, assuming a slightly higher load, top oil temperature was determined to be 63 C. To show the difference between this loading and nameplate loading, hot spot and top oil temperatures were plotted for a

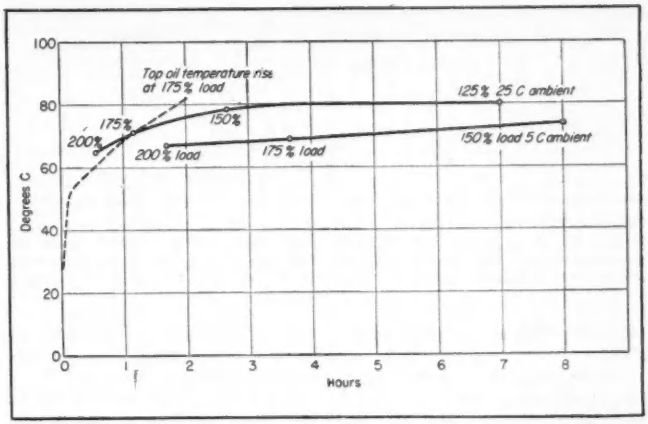


FIG 4—TOP OIL TEMPERATURE was determined by plotting hot spot rises for various loads and times. Top oil gradient subtracted from hot spot temperature gave curves of permissible top oil temperature at ambients of 25 C and 5 C

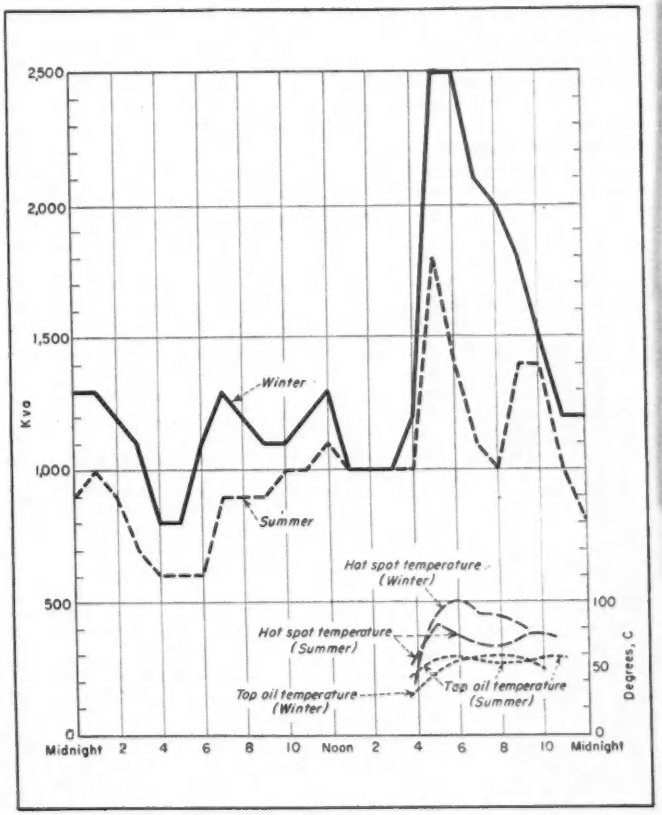


FIG 5—RESIDENTIAL FEEDER carried these loads on July 19 (summer) and Dec. 6, 1949 (winter). Using a winter ambient of 5 C, a transformer rated at 60% of peak would be needed. With a summer ambient of 25 C, a smaller unit would do

* "Electrical Engineering," Oct., 1940
** "Westinghouse Engineer," Feb., 1943

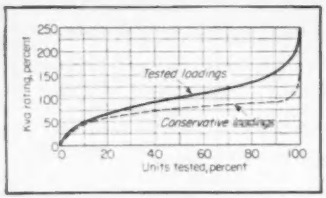


FIG 6—LOADING PRACTICE for transformers based on test of 632 selected units during late 1949 using an indicating split core ammeter

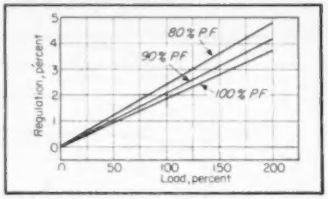


FIG 7—REGULATION of an average transformer for 0% to 200% loads. To show effect of power factor on voltage drop, unit was tested at three loads

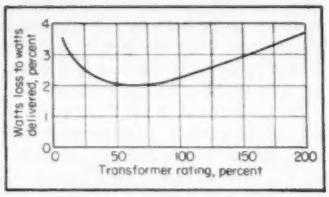


FIG 8—TRANSFORMER LOSSES in representative unit range from infinity at zero load to a minimum at 75% load and then rise with increasing load

transformer loaded at 100% during peak.

Not so long ago when installing a transformer, we picked a size at least 50% higher than expected load. We allowed the load to reach nameplate rating and replaced the unit. This practice resulted in average peak transformer loads of perhaps 75%, which is a long way from the calculated safe load of 167%. In a growing system average transformer load never reaches 167%, but for individual transformers the average can well be over 100%.

Use More Latent Capacity . . . Gradually utilities are utilizing more of the transformer's latent capacity. Recent tests at Syracuse, N. Y., reported 120% average loading on a 2,000-kva circuit. Possibly similar load levels will be realized over a period of years. To achieve this, first, we must accept our present system as a starting point. If transformer sizes were picked on a basis of 100% to 140% of nameplate, over a period of years they would obviously be carrying average loads below 100%. Such units must be left on the pole until higher loads are imposed on them if system load levels are to increase. Second, engineers must change their thinking about loading and establish new criteria for sizing transformers which bear some relation to their replacement loads. Transformer sizes should be thought of as ratings and not as capacities. Third, if we are to operate at higher loads we must have adequate means of monitoring transformer loads.

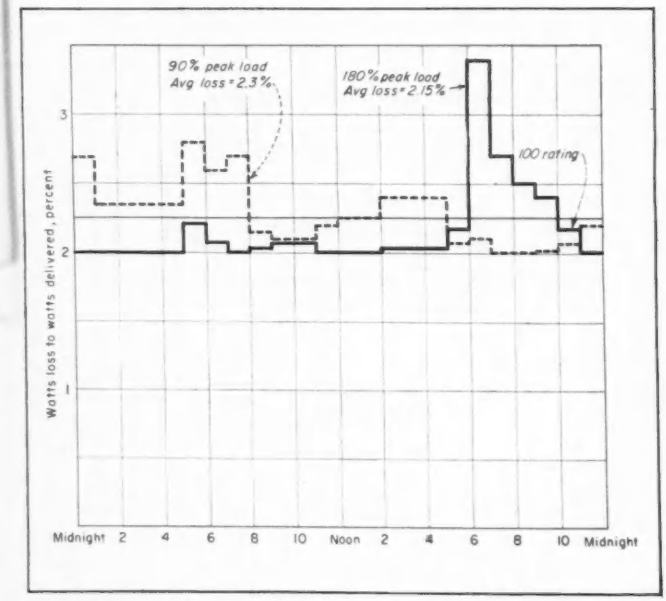


FIG 9—COMPARATIVE LOSSES of two transformers based on curve in Fig 8. Units carried peak loads of 90% and 180%, respectively, in typical load cycles

Methods of Monitoring . . . Paints which change color at different temperatures give an indication of top oil temperature. Tests indicated that a 180 F paint started to change color at 167 F, but it took 2.5 hr to completely change color. No tests were made to determine whether cumulative heating to 167 F would result in complete color change. Paints have the advantage of general applicability to all transformers at small cost. Their disadvantages are short life, burdensome office records, and need of frequent patrols.

Waxes are useful as indicators of top oil temperature. Some of these consist of different colored strips with a wax coating. When the wax melts, the under color appears. Since waxes have rather sharp melting points they should be a more satisfactory means of temperature indication than paint. Otherwise they are likely to have the same advantages and disadvantages as paints. More than one color with different temperatures can be applied if it is desired to obtain warning of approaching overload. These methods of monitoring indicate top oil temperatures at some unknown load and ambient temperature.

How top oil temperatures varies with time and load is shown in Fig 4. Curves were derived by plotting hot spot rises for various loads and times, terminating them at allowable hot spot time and temperature limit. Hot spot over top oil gradient was then subtracted to obtain a permissible top oil temperature curve for 25 C and 5 C. These curves show that allowable top oil temperature varies from

65 C for 200% load and 25 C ambient to 80 C for 125% load and 25 C ambient. For winter loads top oil temperature curve is much flatter and averages perhaps 10 C lower than for the same load duration in summer. This indicates that a temperature device alone without knowledge of ambient and load duration would not give a very exact load indication. It is worth noting that top oil temperatures rise rapidly, as shown on the curve for 175% rating. Any indicator with a time delay may permit higher temperatures than those allowable. However, temperature devices with quicker response might give rough indications of loads for certain cycles.

A Better Method . . . The following scheme is better than indicating readings because it responds to an integrated load. A typical residential feeder with a winter peak load of 2,500 kva and a summer peak of 1,800 kva is shown in Fig 5. Assuming that an individual transformer on this feeder has a similar load curve and that the winter ambient is 5 C, size of the transformer would be about 60% of the peak load. Calculations show that the summer load at 25 C ambient would require a smaller transformer.

From plots in this figure it appears that top oil temperature is nearly the same both winter and summer. Winter hot spot temperature is 18 C higher than in summer. Transformer size chosen is slightly under-loaded at 5 C. However, it is possible to have ambients of 10 to 12 C as evidenced in 1949. Because top oil temperature can be about the same winter and summer, we might expect an alarm at any time. This would not of necessity mean the transformer was overloaded on that day, but that it might be overloaded in winter if load and ambient were high at the same time. This would tend to spread alarms throughout the year instead of bunching them in December.

Split-core ammeters are widely used, but unless load duration and ambients are considered, their readings are only a poor guess as to how the transformer is loaded. It is difficult to test over 5% of the transformers yearly. Therefore, this method is very unsatisfactory. Thermal or recording ammeters would give a better picture, but only 1% or so

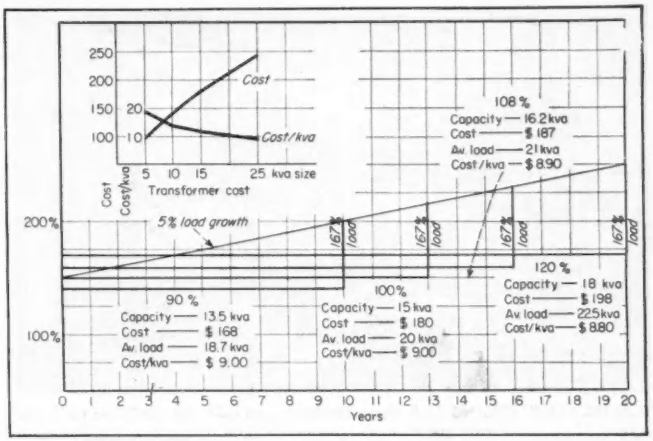


FIG 10—LONGER LIFE SPANS of transformers serve to decrease cost per kva. Average load on transformer with 20-yr span was 22.5 kva, or 125%. The last year of this unit's life is the only period in which overload is approached

transformers could be thus tested annually, and two trips per test are required. On the UI system in late 1949 we tested 632 transformers using split core ammeters. Units with 140% to 150% or more load were arbitrarily replaced. Obviously very few of these were seriously overloaded. In Fig 6 is shown the loading of these transformers in percentage of kva rating. In these tests loads up to 250% were recorded with but one burnout. Eleven other burnouts occurred on transformers not tested. Total burnouts were about 0.1%. Some were due to unusually high ambients existing during the December peak. About 40% of the tests were repeats for 1948. The rest were tests picked up from office records which indicated possible overloads.

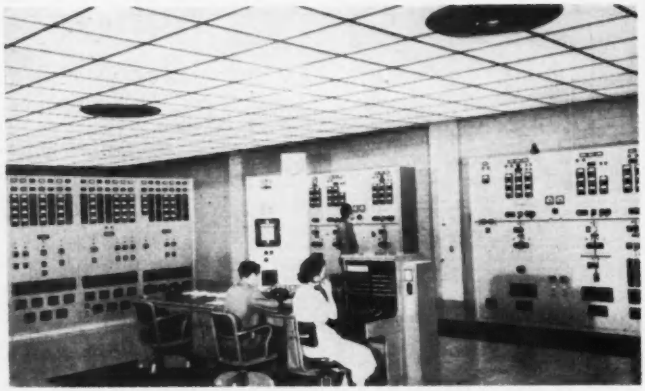
Of this selected group 48% were loaded below rating; 26% were loaded to 75%; 26% to 125%; and 12% at over 150% rating. It is impossible to plot a curve for all transformers on the system, but if it were attempted it would probably be shaped in general like the dotted curve of Fig 6, which might be called conservative transformer loading.

Self-protecting Transformers . . . With secondary breaker and other protective elements like a bimetallic strip heated by top oil temperature and load current, self-protecting transformers offer what is nearest to ideal protection against overloads. Warning against overload approach by red light is a major feature, followed by breaker tripping on dangerous overloads. If such transformers are applied on a system it will be years before they predominate. Cost per kva of delivered load will be less than that of the conventional unit. A new and rather promising device is a metallic link, with melting points between 70 C and 85 C, which actuates a buzzer that in turn vibrates service wires to a point causing noise in adjacent houses. It is installed inside the tank with the thermal link in the top oil. It requires no office records, field tests, or surveys.

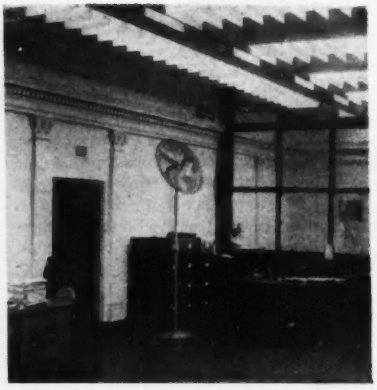
The ideal device for existing transformers would be a bimetallic thermal unit similar to that used in self-protecting transformers. The breaker itself would have to be omitted. The red light or buzzer would probably provide the simplest operation indication. Such a device would be set lower than a self-protecting transformer breaker. The red light could probably be installed with a hydraulic punch on steel tank transformers, but not on cast iron tanks. In this way we might expect much higher loads than now realized, and the required devices would quickly pay their cost through higher utilization.

To carry out control of transformer sizes our 1949 load checks have been evaluated in terms of capacity required to carry one customer with a

(*Continued on page* 180)



PLASTIC PANEL CEILING 11 ft above the floor, with cold cathode lamps on 14 in. centers 17 in. above each row of panels, provides uniform illumination for Barbadoes station control room. Plastic panels are three feet square (Item 11 of table)



AFTER 4 YEARS SERVICE, 90% original lamps in industrial type louvered fixtures mounted 12 ft high produced

Nine-Year Performance Study Throws

Told here are the things Philadelphia Electric Co learned about cold cathode lighting after nine years of studying its performance in power plants, offices, control rooms and laboratories

GEORGE C. SALNEU, Philadelphia Electric Co, Philadelphia

The Philadelphia Electric Company's nine years of experience with the application of some 3,700 cold-cathode lamps clearly demonstrates that they comprise a very reliable, instant-start fluorescent light source that has extremely long life, low depreciation characteristics, and reasonable cost.

Direct outgrowth of the company's research in this field is a new type of cold cathode safety terminal and socket which when coupled with careful terminal box design provides maximum protection from the high voltages involved. The combination takes full advantage of the fundamental simplicity and economy of the series circuit, with a minimum of auxiliary equipment.

In short, series cold cathode lighting and the new lamp termination provide desirable illumination at reasonable cost, with a high degree of simplicity, reliability, continuity of operation, and safety.

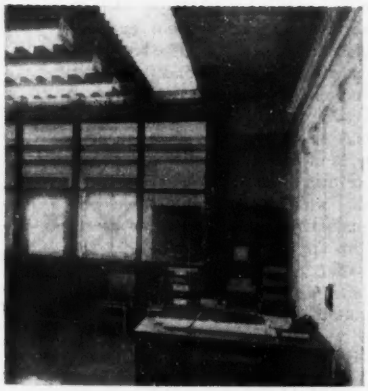
Performance Favorable . . . In service, cold cathode installations indicate a gratifying lack of disturbance, even with wide voltage variations. Illumination has been maintained, and lighting re-established, under test, at as low as 61 volts on nominal 115 volt equipment.

Test installations and early applications provide information on life and depreciation that demonstrates successful results. However, the quantity and duration of experience are insufficient to do full justice to the cold cathode lighting.

Our original trial installation made in 1942 is still burning, and has furnished gratifying results. It has developed one failure out of four lamps at 19,000 hours. Twelve lamps at Richmond Station, now burning over 44,000 hours, experienced one burnout at 20,000 hours. Overall illumination at this installation depreciated to 50% at 38,000 hours with absolutely no maintenance. Cleaning the lamps alone brought a 10% improvement. An early installation at Chester Station in a room where unfavorable lighting conditions existed had illumination restored to 85% of original values when the room was refinished four years later. Lamp replacements, for all reasons, were only 10% during the entire period. This is a big factor in reducing maintenance cost. •

Continuing tests by the Electrical Testing Laboratories on 40 open lamps at Southwark Station, to determine the maintenance of lumen output of the lamps, show average values of 67% at 10,700 hours and 61% at 16,000 hours. Spot checks of various manufacturers' lamps, at other locations, conform closely with these values. A review of lamp replacements in an installation of approximately 600 lamps at Barbadoes Station indicates 1.5% failed in 15,000 hours. Most manufacturers now guarantee cold cathode lamps for 10,000 hours.

No transformer or auxiliary equipment failures have developed during the entire experience with the series installations generally employed and no difficulties have been encountered



85% of initial illumination after cleaning fixtures and refinishing room (Item 2 of accompanying table)

INDUSTRIAL TYPE direct fixtures mounted 9 ft high applied to office section in the company's Central Service Building. Office is that of Meter Testing Section. Note ceiling obstructions in this industrial type building (Item 8 of accompanying table)

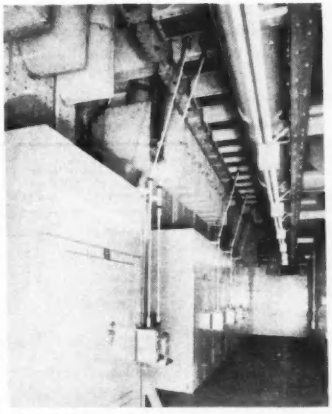
More Light On Cold Cathode Lighting

due to high voltage applications. While some vigilance has been necessary in initial installations, manufacturers have met specifications and lamp efficiencies as high as 49 lumens per watt at the end of 100 hours have been obtained in laboratory tests.

Typical Installations . . . Utilization of this light source has generally been on the basis of its ability to provide a high degree of uniformity over an extended area with low intrinsic brightness and long life. It has found substantial application in the form of pairs of open lamps for operating aisles in electrical sections, corridors, locker rooms, and washrooms, supported either from the ceiling or along the walls. It has been utilized in industrial direct fixtures with and without louvres, luminous indirect units, as well as recessed flush lens-type equipment for laboratory, testing, and office areas. In control rooms, it has been employed in semi-luminous indirect units and luminous ceilings with good results.

A chronological list of the cold cathode lighting installations in use by the Philadelphia Electric Co is included showing the size and type of installation together with operating characteristics. Representative installations are shown in accompanying pictures.

The selection of a light source for any application requires not only a thorough consideration of the problem, but depends to a large extent on the relative value placed on characteristics of available solutions.



AT SOUTHWARK STATION potential transformer compartments and test bus disconnecting switches are lighted with open tubes on 3 inch centers mounted 9 ft high in an aisle 14 ft high (Item 7 of the accompanying table)

The long, narrow, and frequently high aisles in electric operating areas and corridors, needed a continuous low-brightness light source to provide uniform illumination. Here seeing tasks were not especially critical or prolonged. High levels of illumination were not a necessity, but comfortable seeing was required not only on the floor, but on equipment along the sides and occasionally on the ceiling.

In station control rooms, low brightness light sources, which provide optimum uniformity of illumination with freedom from glare and shadows were required. Here seeing tasks involved constant observation and periodic reading of many instruments, together with the reliable operation of important control devices. Emphasis was placed on properly designed diffusing and control equipment rather than extremely high lighting levels.

Other low brightness applications developed in locker rooms, washrooms, and office areas. Occasionally architectural considerations required the use of specially shaped lamps to provide proper treatment in areas where appearance was the primary consideration. In all cases long lamp life, immunity to wide voltage varia-

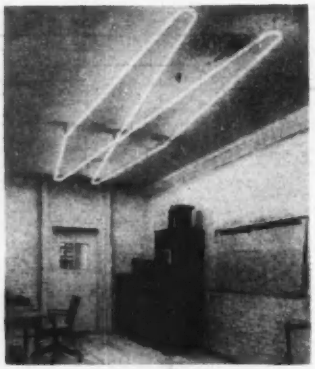
tions, instant starting, freedom from auxiliary troubles, and safe operating characteristics were distinct advantages.

While reasonable installation and operating costs were required, the reliability as well as the continuity of operation were important considerations in most of the applications that were made.

A fluorescent type of light source lent itself rather naturally to the problem since the light is diffused over a substantially extended linear area; its efficiency is approximately double that of an incandescent lamp and it is available in a wide variety of suitable shades of color.

We selected a 93 in. 25 mm. 3500 deg white cold cathode lamp having 6 mm pressure and right angle terminals, with guarded contacts in the terminals and receptacles. These lamps operate in series at 100 milliamperes. They are required to provide a certified minimum of 1800 lumens at the end of 100 hours burning. Output values above 2100 lumens are now being obtained.

Design Considerations . . . This decision in favor of the cold cathode lamp was based on certain favorable characteristics of the lamp and the circuits involved. Superficially the cold-cathode lamp is simply a particular type of fluorescent lamp. The conventional glass tube is coated internally with a fluorescent powder and encloses a small amount of inert carrier gas and mercury. An electric discharge occurs through the gas and mercury when energized between electrodes or cathodes located at each end of the lamp. In cold cathode lamps these are usually substantial metal shells, instead of less durable filaments which generally require preheating and auxiliary starting devices. Cold cathode lamps utilize high voltage, which creates the initial discharge that enables them to start instantly and "cold." Thus starting auxiliaries such as switches and condensers, which are a frequent source of trouble, can be avoided and the supply facilities reduced to a simple transformer with a condenser for power factor correction.



ORIGINAL TRIAL INSTALLATION burning over 19,000 hours utilized 14 ft "V" shaped open lamps arranged in a diamond pattern on a 10 ft ceiling in a service building office (Item 1 of table)

Tests indicate that cold cathode lamp brightness is substantially less than that of the conventional fluorescent lamps, thus permitting them to be used exposed without annoying glare. Control is also more readily accomplished where greater diffusion and uniformity is required. Although it is recognized that initial efficiencies may be slightly lower than for other types of fluorescent lamps, indications are that overall costs compare favorably with other suitable forms of illumination, especially where energy costs are low.

Cold cathode lamps may be connected in multiple for installation in stock 2 or 4 lamp fixtures, or as many as twelve lamps may be connected in series with a still further reduction in the auxiliary equipment and a substantial reduction in wiring. With series operation the use of a mid-point ground in the lamp circuit permits partial illumination of the circuit in the event of a lamp failure.

The use of a terminal at right angles to the lamp produces the maximum luminous lamp length. It also tends to confine the region of darkening to the vicinity of the electrode and limit its extension into the luminous section of the lamp. In addition it minimizes the unilluminated section between the ends of adjacent lamps and permits guarding for the electrode in the event of lamp breakage.

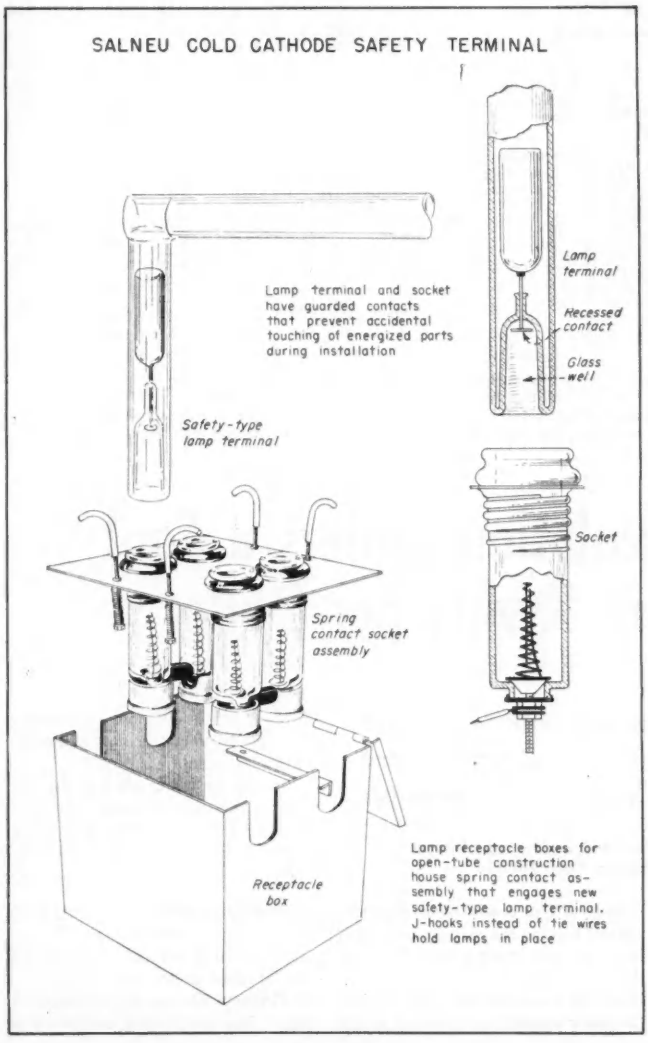
The Safety Problem . . . It was soon found that the lamp terminals and sockets commercially available for series operation of cold cathode lamps permitted workmen to come in accidental contact with energized parts while installing or replacing lamps in the event that an isolating switch was not reliably blocked open during the process. These parts may have potentials as high as 6000 volts above ground with current of dangerously high value. As isolating switches are frequently disregarded for lamp replacements and since low voltage switches may not provide a very positive indication of their position and are not generally depended on to block high voltage circuits reliably, it was considered necessary to provide additional protection. Several methods were available to lessen these hazards such as extending low voltage circuits through switches in lamp receptacle boxes or by means of relay circuits. These methods add complications, reduce many of the advantages of the fundamentally simple series circuit,

History of Philadelphia Electric Company Cold Cathode Lighting Installations

Date of Installation	No. of Lamps	Location	Application	Hours of Daily Operation	Type of Luminaire	Initial Foot Candles
3- 1-42	4	Central Service Bldg.	Trial Installation	8	Open Tube	15
9-17-45	72	Chester Station	Office	8	Industrial Direct Louvred	35
9-28-46	12	Richmond Station	Test Installation	24	Open Tube	9
9-13-47	33	1000 Chestnut Street	Executive office	8	Flush Lens	35
12- 1-47	212	Southwark Station	Control Room	24	Asymmetric Semi-Luminous Indirect	50
12- 1-47	170	Southwark Station	Office	8	Commercial Luminous Indirect	42
12- 1-47	1748	Southwark Station	Electrical aisles, corridors, locker and washrooms	24	Commercial Open Tube	10-15
3- 1-48	356	Central Service Bldg.	Meter Testing Section	8	Industrial Direct	44
3- 1-48	216	Central Service Bldg.	Chemical Laboratory	8	Industrial Direct	59
7- 1-49	414	Barbadoes Station	Electrical aisles, corridors, locker and washrooms	24	Open Tube	10-15
7-20-49	192	Barbadoes Station	Control Room	24	Luminous Ceiling	52
7- 1-51	262	Richmond Station	Control Rooms	24	Luminous Ceiling	50

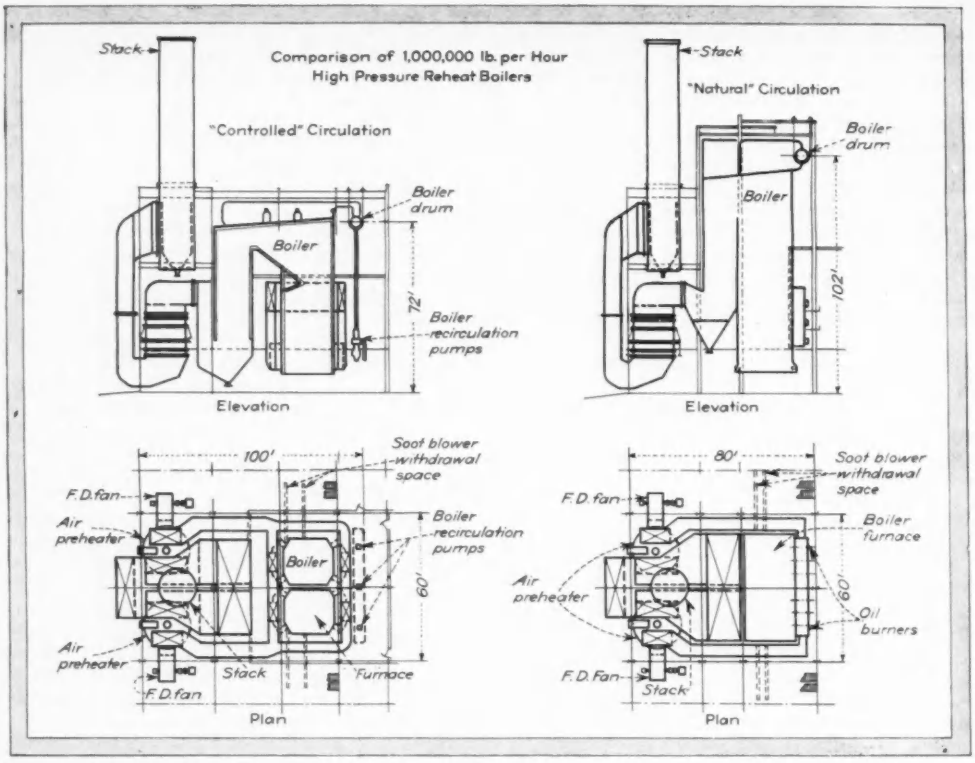
and generally involve periodic testing and maintenance to assure continuous reliable operation of the devices.

To avoid these disadvantages the author developed a lamp terminal and socket with guarded contacts which, it is believed, provides all of the protection necessary without the addition of auxiliary equipment. This lamp terminal is constructed of a glass exterior of much the same size as the conventional terminal with a contact so arranged in a glass well or recess that no exposed contact may be inadvertently touched or approached within flashover distance while changing a lamp. Whereas the conventional terminal has an exposed metal ferrule or contact member soldered to wires connecting to an electrode through a pinch seal of an outer glass tube, the author's cold cathode safety terminal is distinguished by a small contact button welded to wires connecting to an electrode through a pinch seal of an inner glass tube in which the contact button is deeply recessed. This assembly is ring sealed to an outer glass tube so that the contact is in a protected position in the terminal thus produced. The new terminal engages the matching cold cathode safety socket in which the short large diameter spring of the conventional socket has been replaced with a tapered spring of the proper length and diameter to fit the recess in the lamp terminal and exert positive pressure on the contact button. In order that adequate clearance shall be maintained at all times between the spring contact and the mouth of the socket, an interlocking feature has been incorporated consisting of a restraining hook in the top of the spring which engages a similar hook in the bottom of the spring. Both of these hooks are well turned back on themselves so that they cannot be readily disengaged when assembled. This prevents the spring from being withdrawn should an arc develop which might weld it to the lamp contact. It also has the desirable feature of resisting any deliberate attempts to elongate the spring contact member.


SALNEU COLD CATHODE SAFETY TERMINAL
Lamp terminal and socket have guarded contacts that prevent accidental touching of energized parts during installation
Lamp terminal
Recessed contact
Glass well
Safety-type lamp terminal
Socket
Spring contact socket assembly
Receptacle box
Lamp receptacle boxes for open-tube construction house spring contact assembly that engages new safety-type lamp terminal. J-hooks instead of tie wires hold lamps in place

These devices are simply constructed and do not involve any moving parts which are likely to get out of order. Discussion of this development with Underwriter's representatives indicated agreement that these devices incorporated distinct advantages over those generally utilized for series cold cathode lighting. Technical problems which presented themselves in the development of this terminal have been overcome and no difficulties have been experienced in service. Although the manufacture of this equipment thus far has been on a limited basis, assurance has been received from the manufacturers that in production the cost of these devices would be very little more than the cost of the conventional terminals and sockets.

Lamp receptacle boxes were designed and utilized for open tube construction so that parts of elevated potential were normally inaccessible without interrupting the high voltage circuit. J-hooks were utilized to hold the lamps in place instead of the conventional tie wires thus providing a more convenient means for lamp installation and replacement. The outstanding features of the new type of Cold Cathode termination thus obtained are safe, simple, convenient, and reliable means of operation, all of which are highly desirable.



CONTROLLED CIRCULATION steam generator of 1,000,000 pounds per hour with reheat at 2,000 psi requires 30% less vertical space than comparable natural circulation units. Early major operating problems are now being solved

Forced Circulation Boilers a Tool For More Kwhrs per Dollar

Montaup success sustains intensified resort to technique that should save on building, afford added capability, and less maintenance, as well as conserve critical materials

WILLIAM F. RYAN, Vice President and Engineering Manager
Stone & Webster Engineering Corp, Boston

For the first sixty years of the power industry, the primary objective was more kilowatthours per pound of fuel. For the present, and perhaps for the indefinite future, the battle is to win more kilowatthours per dollar invested. A few power plant designers are still fighting the old war, and fighting it valiantly, but not entirely aware that they are facing a new enemy, to be met by a new strategy. Fortunately, the power industry as a whole is awake to the changed situation, and seeking every means to cut the cost of electric generating plant.

Among the newer allies in the war against excessive investment in generating plant is the forced circulation boiler, or the "controlled circulation" boiler, as the manufacturers prefer.

Montaup Pioneered . . . The first large high pressure boiler in the United States utilizing controlled circulation was installed at the generating plant of Montaup Electric Co at Somerset, Mass. This installation, completed in

1942, and its early operating experience, have been described in detail in several publications.[1]

The Montaup boiler was designed for operation with 2,000 psi drum pressure and a steam temperature of 960 F at the superheater outlet, supplying steam at the rate of 650,000 lb per hr to a 20,000 kw (name plate rating) topping turbine, and reheating the exhaust from this turbine to 750 F. Under these conditions, the turbine generator produces 25,000 kw continuously. The reasons for adopting forced circulation at Somerset have also been published in detail[2] and may be summarized by stating that the objective was to obtain the greatest possible amount of topping power from a given space in an existing building, and within a definite appropriation. These objectives were fully realized, but there were major operating difficulties for an extended period.

Early Difficulties . . . During the early operation of the Montaup boiler, unforeseen difficulties developed in boiler water conditions. Similar difficulties arose with a "natural" or thermal circulation boiler installed about the same time at Twin Branch, Ind., for operation at somewhat higher pressure. In both cases, precipitation of salts occurred due to the fact that the solubility of phosphate and sulphate salts decreases as the temperature rises in the high pressure boiler range and is rather low above 600 F where the vapor pressure of the sulphate salt and, apparently, that of the phosphate coincides rather closely with the vapor pressure in the boiler. The saturation temperature at 1,800 psi is 624 F. In both plants, unfavorable chemical conditions were markedly benefited by substituting potassium salts for sodium salts in the feed water treatment and, for the Montaup installation, the ultimate correction was attained by limiting the chemical dosage closely to actual requirements.

Pump Seals . . . Another major difficulty at Montaup was with the sealing of the circulating pumps. At no time was there a failure of circulation, or boiler outage due to the pumps, but the pumps had to be extensively rebuilt to hold down gland leakage.

During the intervening years, the early difficulties at Montaup have been overcome; for the past three years, the availability of this unit has exceeded the average reported for boilers of comparable size and operating conditions. The experience with this boiler has demonstrated the considerable advantages of controlled circulation, and has shown the way to design future installations which should be entirely free from early difficulties experienced at Montaup with the original installation.

Saves Space and Money . . . In an effort to combat the steadily mounting cost of steam generating plant for large public utility installations, the designers of Montaup have naturally considered the space and money savings realized there by forced circulation and, early in 1950, concluded that the experience with the pioneer installation would justify returning to that design for steam generation. In July 1950, the purchase of a 750,000 lb per hr reheat unit, operating at 1,450 psi, 1,000 F/1,000 F, designed for controlled circulation, was recommended for installation at the Chesterfield Station of Virginia Electric & Power Co and will supply steam to a 90,000 kw preferred standard turbine generator, the first preferred standard unit of that size to be purchased. A similar boiler has been purchased for the same utility for a new power station at Gilmerton, Va.

Seventeen Ordered . . . Seventeen large forced circulation reheat boilers are now on order, among them two units, each having a capacity of 920,000 lb per hr, operating at 1,800 psi, 1,000 F/1,000 F, for the new Etiwanda Station of Southern California Edison Co. In that installation, controlled circulation made it possible to allow a much higher pressure drop in the steam leads and also to carry more pressure at the turbine throttle under emergency operating conditions when greater flow through the turbine may be required. The 1¼ in., 1½ in., and 1⅝ in. OD boiler tubes of the controlled circulation unit are suitable for an operating pressure of 2,332 psi compared with 2,010 psi for 3 in. OD tubes normally furnished with 1,800 psi natural circulation boilers. A slightly thicker drum and somewhat thicker superheater tubes are required for the higher pressure, but the incremental cost is not significant. The extra 50 psi which may be carried at the turbine throttle for short periods is an important factor in obtaining the expected maximum capability.

Critical Materials . . . The relative sizes of forced and natural circulation boilers of 1,000,000 lb per hr capacity are illustrated herein. With many boilers now being installed out of doors, the smaller volume of the forced circulation effects no appreciable saving in building volume, but the pressure parts of a 900,000 lb per hr, 1,800 psi reheat forced circulation boiler weigh approximately 350,000 lb less than a comparable natural circulation unit. Also the operating water content is only about one-third that of the comparable natural circulation boilers. The lower weight and lower height result in substantial savings in cost of structural steel and foundations. At this particular time, the substantial savings in critical materials is an advantage not readily measured in dollars. The lower height is also advantageous in an earthquake area.

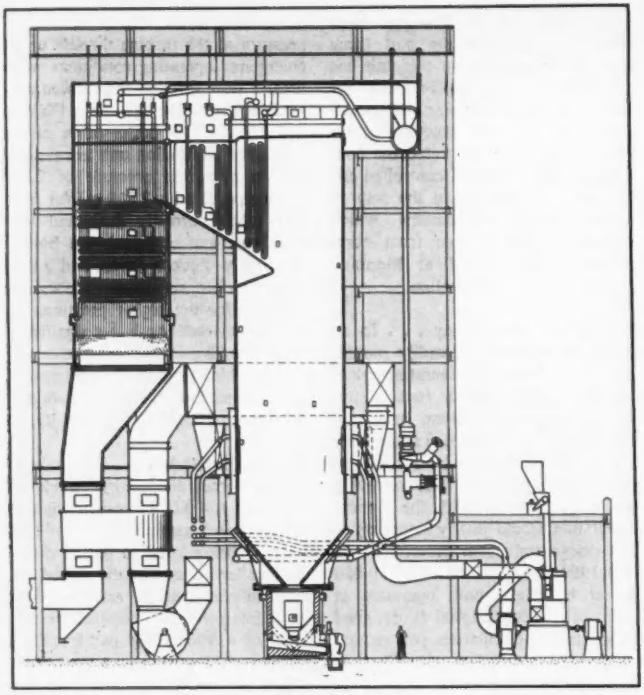
As controlled circulation boilers employ tubes of smaller diameter, with correspondingly thinner walls, skin temperature is materially less for equal rates of heat absorption than in the case of natural circulation

Ratings of 17 Controlled Circulation Boilers Soon To Be Installed on Nine Utility Systems

	Capacity per unit (lb per hr)	Design Pressure (psi)	Steam Temperature (Fahrenheit)
Virginia Elec & Power Co	750,000	1670	1000–1000
Duke Power Co	900,000	2010	1000–1000
Wisconsin Elec Power Co	795,000	1775	1000–1000
Southern Cal Edison Co	920,000	2100	1000–1000
Cleveland Elec Illum Co	875,000	2030	1000–1000
Public Service Elec & Gas Co	1,015,000	2650	1100–1050
Wisconsin Elec Power Co	795,000	2050	1050–1000
Philadelphia Electric Co	1,450,000	2075	1000–1000
Consumers Power Co	1,050,000	2300	1050–1000

[1] Transactions ASME, vol. 68, 1946, p. 411
vol. 65, 1943, p. 461

[2] Transactions ASME, vol. 65, 1943, p. 467



TYPICAL of the coming wave of forced circulation boilers is this unit for an Eastern metropolitan system which will soon be put into service

boilers. With lower skin temperatures, maintenance is less and availability greater on these new units.

Maintenance Facilitated . . . Since water circulation is definitely proportioned through each of the boiler circuits, outage from tube failure is less frequent, and service can be restored more rapidly if failure should occur; experience at Montaup shows that the furnace can be cooled rapidly, allowing maintenance men to enter the furnace soon after the fire is extinguished. By controlled circulation of water throughout the unit, time for starting and shutting down is shortened, with a reduction in "standby" fuel consumption.

With a controlled circulation unit, the rate of circulation in relation to steam generation is only little more than half as much as with natural circulation, which means that the ratio of steam to water passing through the drum separators is greater. Reduction of water loading in the steam separating equipment reduces the solids carryover with accompanying higher sustained efficiency and capability of the turbine unit. A high pressure drop through the steam separators is favorable to efficiency of purification. As previously stated, a high excess of drum pressure over throttle pressure is obtained at reasonable cost. Revision of the drum internals at Montaup, to take full advantage of the available pressure drop, appears to have eliminated any measurable deposit on the turbine blades. Pure steam means more kilowatthours per year from the installation and, in this respect, forced circulation yields more killowatthours for fewer dollars.

Skin Temperatures Down . . . When a furnace wall in a natural circulation boiler becomes slagged up, the heat input to that portion is reduced and circulation is decreased. When a patch of the slag falls off, the rate of heat input at the clean portion of the wall is greatly increased but, because of relatively poor circulation in the rest of the tube, the skin temperature rises markedly at that spot. With controlled circulation, each tube gets its proper allotment of water which tends to keep tube skin temperature down to proper limits, even under this adverse condition.

Controlled circulation makes it possible to provide water-cooled supports for the superheater, reheater and economizer, and the resulting lower temperature reduces attack by fuel oils having metallic salts, such as vanadium. In natural circulation boilers, such fuel oils cause serious deterioration of superheater spacers and supports even when the latter are made of expensive alloys such as 25 chrome-12 nickel. If water-cooled supports are used with a natural circulation boiler, an outside source of water is necessary, with consequent loss of heat and thermal efficiency.

High Transfer Rate . . . The Montaup installation has demonstrated that very high rates of heat transfer may be used with controlled circulation, but more conservative values are being used on the recent installations, although they are higher than would be considered desirable for natural circulation. At Chesterfield, the total furnace volume is not much less, relatively, than at Montaup, but the use of twin furnaces, each corner fired, provides a relatively greater cold envelop.

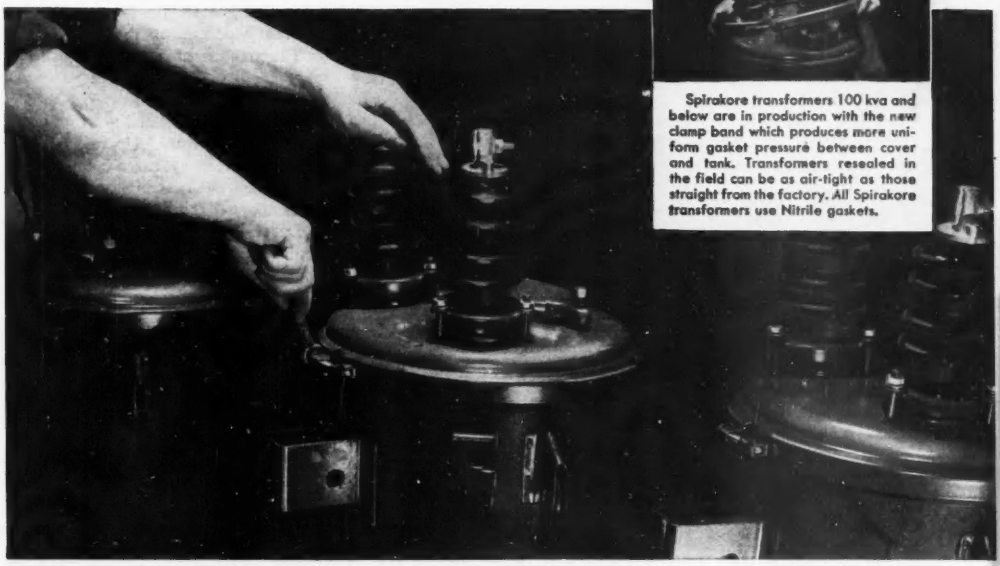
Development of forced circulation would undoubtedly have been more rapid had it not been for the war years and the subsequent demand for rapid expansion of the country's electric generating capacity between Montaup and Chesterfield. More than 15,000,000 lb per hr of forced circulation capacity, now on order, is evidence that lost time is being made up.

Approximate Values for Heat Release

	Montaup Boiler	Chesterfield Boiler	Comparable Natural Circulation Boiler
Furnace heat release, Btu/cu ft	25,800	24,400	17,700
Furnace heat release, Btu/cu ft of envelope	150,000	98,000	96,500

New cover band makes seal on G-E Spirakore* transformers even better

Spirakore transformers 100 kva and below are in production with the new clamp band which produces more uniform gasket pressure between cover and tank. Transformers resealed in the field can be as air-tight as those straight from the factory. All Spirakore transformers use Nitrile gaskets.

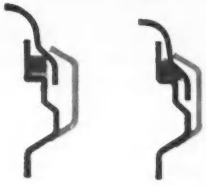


The cover on General Electric distribution transformers is now clamped against its Nitrile rubber gasket by a clamp band or ring. This produces uniform gasket pressure around the entire cover rim—results in even better sealing and resealing than ever before.

As in the past, breathing is completely stopped in G-E Spirakore transformers. Sealing is air-tight so that moisture-laden air can't be drawn into the tank to contaminate oil and shorten transformer life. Yet with this sealing, the new clamp actually improves accessibility. One bronze bolt holds the cover tightly in place. Loosen it, and band and cover lift right off. No adhesives to break—no surfaces to clean before resealing. You even re-use the same gasket.

Better sealing is only one of the reasons why Spirakore is the finest transformer you can buy. The full story is told in Bulletin GEA-5400. If you haven't a copy, write for one today. Address *General Electric Company, Schenectady 5, New York.*

*Registered trademark of the General Electric Company.



BEFORE TIGHTENING **AFTER TIGHTENING**

The brown represents the Nitrile rubber gasket which is of square cross section. The red is the new clamp band. When the band is tightened, the cover is drawn down against the gasket, compressing it and making an air-tight seal.

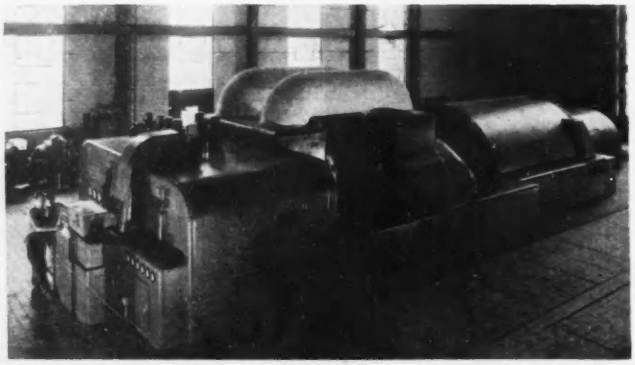
All openings—hand holes and bushings as well as cover—are sealed with Nitrile gaskets which are resistant to oil, age, sunlight and operating temperatures.

402-111

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

Supercharged Generator Cooling Saves Critical Materials



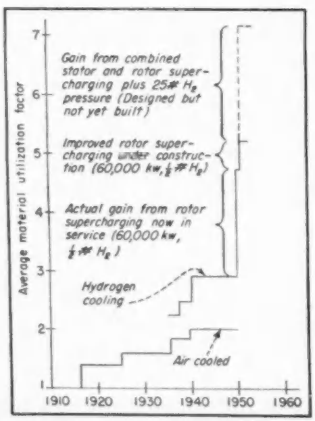
FIRST SUPERCHARGED hydrogen-cooled generator went into service at Edgewater Plant of Wisconsin Power & Light Co in June. Unit is rated 60,000 kw, 12.5 kv, 3,600 rpm. Supercharged design allowed frame size to be reduced by one-third

STERLING BECKWITH
Engineer-in-Charge
A-C Design
Motor and Generator Section
Allis-Chalmers Mfg Co
Milwaukee, Wisconsin

In the face of the most critical material shortage in history, an improvement has been made in the design of electrical equipment that promises substantial savings in copper and steel. Recourse to "supercharged" hydrogen-cooling of generators means that four turbine-driven generators can be built in 1952 with the material required for three in early 1951.

However, the original purpose of the development should not be considered as entirely that of finding a method of saving material. In a sense this development comes as a logical step in the use of hydrogen for cooling high-speed generators.

Since boiler pressures, and turbine speeds, have been controlling factors in generator design, rotors have been long and small in diameter. Ability to remove the heat from a rotor has been the factor limiting generator capacity. The solid curves in the accompanying chart show the traditionally incomplete utilization of material in the best modern hydrogen-cooled generator, since it would be practical to operate at 200% load if it was possible to get the heat out of the windings of the alternator.



PROGRESS in utilization of material in turbine-driven generators is shown. Vertical axis is based on D L (diameter² x length) per kw factor used in design

The greatest advantage that hydrogen cooling offered, when it was applied to turbo-generators about 1937, was increased ability to remove heat from the rotor. Up to the present, however, hydrogen-cooled machines have been essentially air-cooled units adapted for hydrogen cooling.

Development of supercharged cooling, over the last several years, began with the concept of a completely hydrogen-cooled machine. To achieve this, hydrogen must pass directly over the conductors and at a much higher velocity than has been used up to this time. With this arrangement, a compressor is not required at both ends of the machine. But the compressed gas can be carried the required distance along the rotor by a relatively small duct. A multistage blower that is a modified centrifugal compressor is mounted directly on one end of the rotor where it does not interfere with rotor removal. This compressor provides pressure differentials of five to ten times as great as present practice. Any change in the static hydrogen pressure within the machine will have a much greater effect than with present designs.

The change in conductor cross-section is probably the most interesting phase of this development. As shown in the sketch two conductors wound face to face provide two semi-elliptical ducts along which the hydrogen travels. Heat removal efficiency of this design is such that in a 60,000 kw unit hydrogen traveling through the rotor is increased 50 C in temperature in less than one-fiftieth of a second.

Stator ventilation and construction used in supercharged machines now in service and those being built are essentially the same as standard machines except for a small amount of extra copper required. However, de-

(*Continued on page* 122)

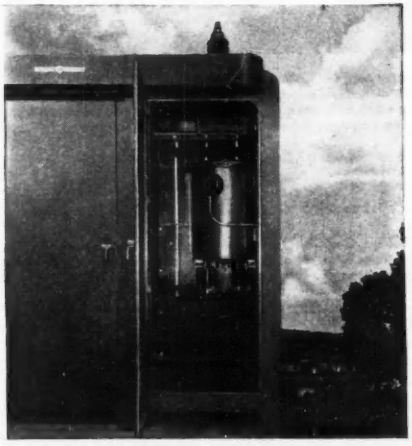
LOW-COST OIL SWITCH for capacitor installations

The Type B-1 Capacitor Switch was recently developed by General Electric to reduce the cost of switching capacitor banks. Designed with a high momentary current rating, a long contact life, and the ability to interrupt rated capacitor current without introducing abnormal overvoltages, the switch is being widely accepted. More and more housed capacitor equipments are being furnished with the switch, and a number of switches are being supplied for use with pole-mounted capacitor banks.

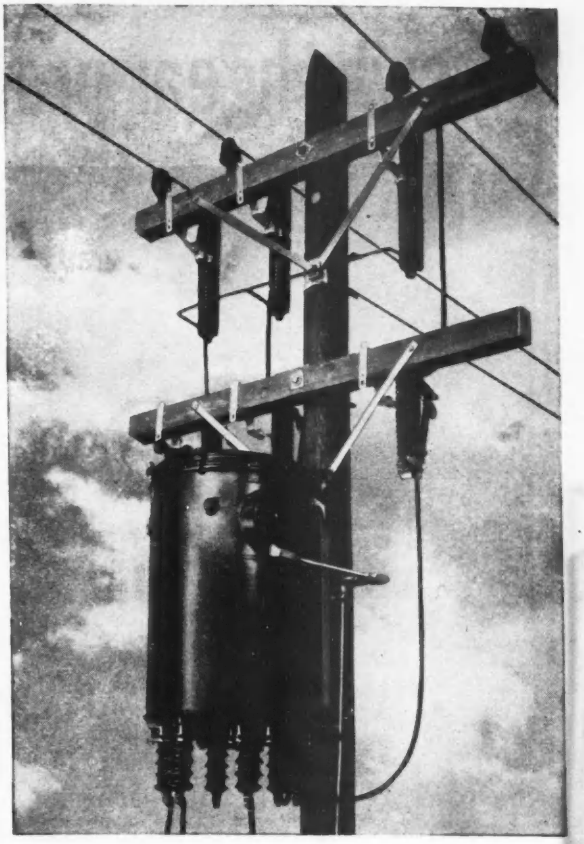
Rated 150 amperes, 15,000 volts, three-phase, the B-1 Switch will handle capacitor banks up to these kvars (includes 135% factor as outlined by NEMA).

450 kvar at 2,400 volts
800 kvar at 4,160 volts
900 kvar at 4,800 volts
1,350 kvar at 7,200 volts
2,400 kvar at 12,470 volts
2,700 kvar at 13,800 volts

Contact life—20,000 operations at 150 amp.
Momentary current—40,000 amp. RMS.



Within its maximum rating, this switch is considerably lower in cost than circuit breakers for capacitor equipments.



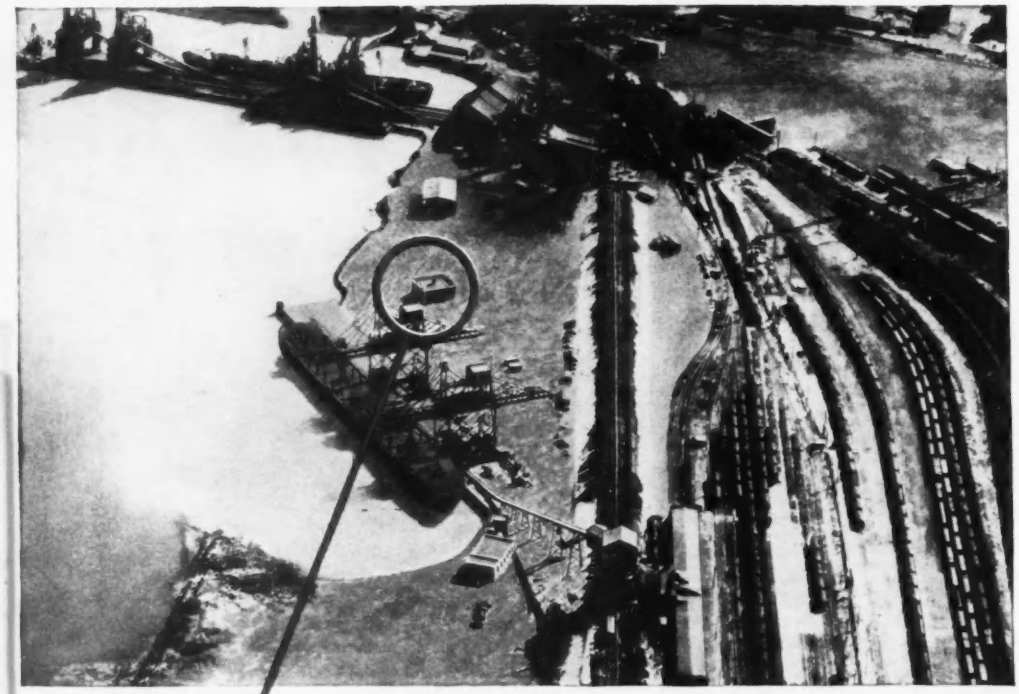
The B-1 Switch can be actuated by any control circuit which will supply one ampere at 120 volts, 60 cycles. It opens and closes all three phases with a double-break action, using six sets of arc-resisting contacts operating under oil. High-speed closing as well as opening is achieved by a toggle-actuated spring mechanism. A 1/30-hp motor charges the spring in approximately seven seconds. Tank diameter is 21 inches; over-all height, from top of tank to bushing terminal, is 43 inches; weight, including oil, is 500 pounds.

If this switch appears to have possible application on your system, ask for Bulletin GEC-801. A copy can be secured from your G-E Apparatus Sales Office, or by writing General Electric Co., Schenectady 5, N. Y.

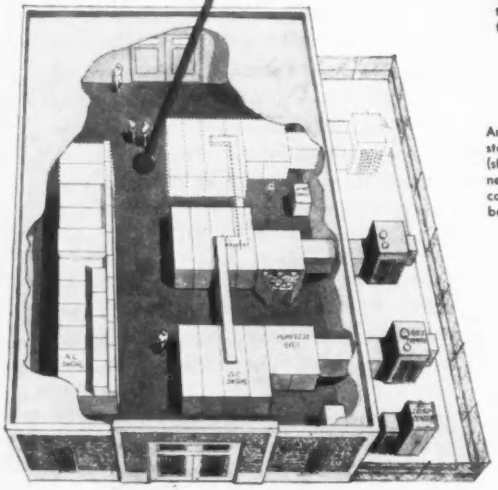
4C7-34

GENERAL ELECTRIC

G-E switchgear protects operation



Aerial view of the new Baltimore and Ohio ore facility in the Curtis Bay section of the Port of Baltimore. Circled building marks location of the modern G-E substation equipment which supplies power for the two unloaders and two General Electric pusher locomotives that are used to spot gondola cars for loading.



Artist's drawing of the G-E substation showing two 1000 kw d-c substations, a-c substation and metal-clad switchgear. Additional units (sketched in phantom form) show location of the equipment that will be needed for future plans which call for doubling the present unloading capacity. Another d-c load center and two more switchgear units will be needed.

# of new $5,000,000 investment!

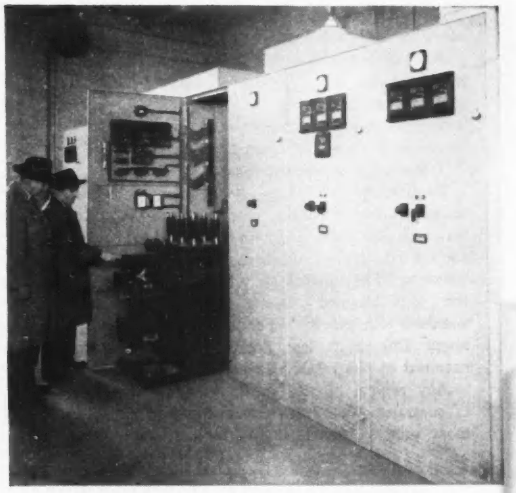
New B&O unloaders move 2000 tons an hour around-the-clock. Continuous power supplied with modern d-c substation and metal-clad switchgear.

Strategic ore from Liberia and South America takes less time to get to the nation's steel producing centers when it is unloaded at the Baltimore and Ohio's new ore facility in the Curtis Bay section of the Port of Baltimore.

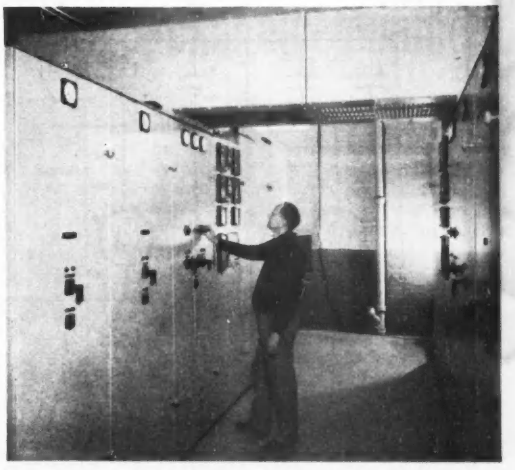
Incorporating the latest improvements in design and equipment, the new ore dock has a working capacity of 2000 tons an hour. The two highly efficient unloaders reduce turn-around time for ore boats and provide an almost continuous stream of ore-laden railroad cars for iron and steel mills. These same cars return to Baltimore loaded with coal, give B & O a two-way pay load for greater efficiency.

Continuous power for 24-hour operation is supplied by modern G-E substations. Two 1000 kw d-c substations supply the main power for the entire installation, while an a-c substation supplies auxiliary power and lighting. G-E metal-clad switchgear provides control and protection for the incoming and outgoing feeders to a-c and d-c load centers.

Forward-looking G-E engineers are ready to apply the knowledge gained from this, and hundreds of other installations, to *your* problems. Investigate today the many advantages of using General Electric switchgear in your plant for efficient, flexible power distribution. Contact your G-E sales representative, or write for bulletin GEA-3083 Metal-clad switchgear. General Electric Company, Schenectady 5, N. Y.



G-E metal-clad switchgear for the 13.2 kv feeders to a-c and d-c substations. All components are metal-enclosed for protection to personnel. Because units are factory-built and arrive ready to install, total installed cost is greatly reduced.



View of the operating aisle of the d-c substation. New G-E pumpless rectifiers provide continuous low-cost d-c power conversion. Minimum number of moving parts reduces maintenance. All parts are easily accessible.

GENERAL ELECTRIC

854-38

Supercharged Generator

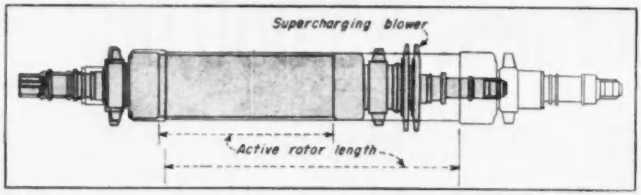
(*Continued from page* 118)

igns of a completely-supercharged machine are largely completed and it is hoped test data on this next most promising step can be made available soon.

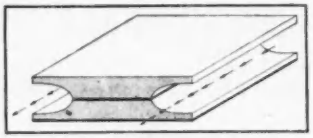
Air gap in the new design has been increased to maintain the standard short circuit ratio. Subtransient reactance is about 50% higher and short circuit currents will be limited to about 2/3 that of standard machines.

Evaluation of these changes in terms of lower breaker, reactor, and buswork costs will undoubtedly show substantial savings. Powerhouse construction costs too will be reduced as the supercharged design replaces standard equipment. For example, about 250 sq ft less floor area is required by the 60,000-kw size.

Any radical change in the design of a major piece of electric equipment such as this is bound to have far reaching effects. In the near future, it may be practicable to consider machines rated much higher than previous limits. With the development of stator supercharging, it may be worthwhile reconsidering helium as a cooling medium. It is also possible that ultimately the return generator cooling water may be utilized to greater advantage in the feedwater cycle, since the outlet water temperature may be higher and since inlet gas temperatures higher than 40 C ambient will be feasible.

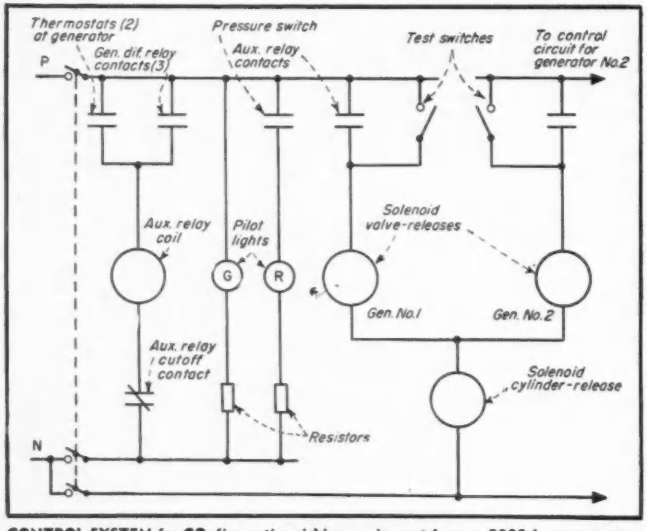


COMPARISON of supercharged (shaded) and standard rotors shows saving in copper and steel, particularly in active rotor length. Bearings, seals, couplings, and shaft are smaller too. In addition, for a 60,000-kw unit, powerhouse width can be reduced by 9 ft because less space is required to remove the rotor



CONDUCTOR DESIGN calls for conductors to be in multiples of two, with insulation between. Gas flow (arrows) is such that almost all the heat is carried away

Isolate Generator CO_2 System Controls



CONTROL SYSTEM for CO_2 fire-extinguishing equipment for two 5000-kva generators uses 3-pole switches in battery feeds to permit isolating of controls for any generator for maintenance. System may be used for several generators

FRANK E. REEVES, Director Electrical Instructions, Baton Rouge, La.

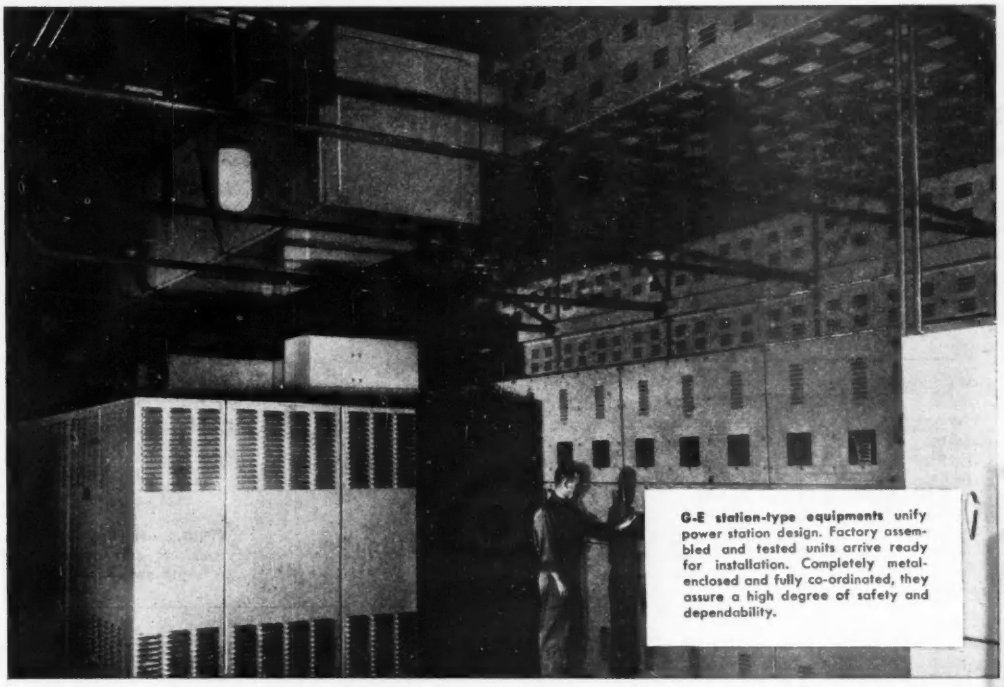
By installing a 3-pole control switch instead of the customary 2-pole switch for killing the dc controls on a generator control panel, it is possible to isolate the generator CO_2 controls.

System under discussion uses an automatically operated release on the CO_2 cylinders. The coil of the solenoid release for the cylinders is connected in series with each generator valve solenoid as shown. Two thermostats in each generator in the cooling air duct are set to close when air temperature becomes excessive. Through an auxiliary relay they energize the solenoid of the valve release for the particular generator and the solenoid for the cylinder release. The gas will flow into the generator windings. Closure of the contacts of any one of the three current differential relays will have a similar effect.

By adding a third pole both the clip and the blade of the additional pole will be "hot." The clip will be alive from the battery bus, and the blade from the control switches on all other generator control panels. Being in the tripping circuit, this wiring is unfused. As a precaution, a tag on this pole should warn that the blade is alive whether switch is open or closed.

A green pilot light indicates when the fire extinguishing system is energized. A red pilot light, operated by a pressure switch, shows when gas is feeding into the generator.

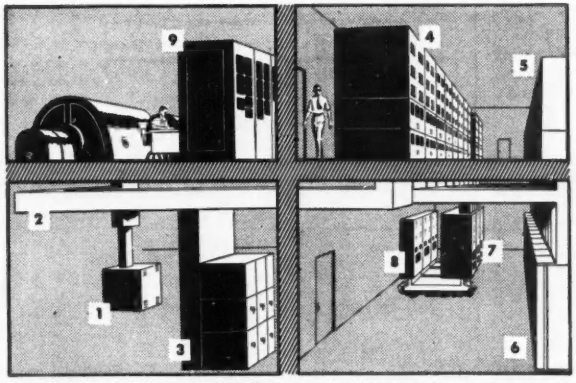
Test switches are provided to check the operation of the valve and cylinder releases.



G-E station-type equipments unify power station design. Factory assembled and tested units arrive ready for installation. Completely metal-enclosed and fully co-ordinated, they assure a high degree of safety and dependability.

FORMULA FOR UNIFIED POWER STATION DESIGN . . .

Complete project planning with packaged equipment



Artist's view of typical station switchgear, of which the various components are: (1) Neutral grounding breaker and resistor; (2) Generator buses; (3) Generator surge and potential transformers; (4) Generator and feeder cubicles; (5) Feeder transfer bus; (6) Feeder cable entrance units; (7) Synchronizing reactors; (8) Synchronizing bus; (9) Duplex control board.

G-E station-type equipments provide the modern method for getting unified power station design. These standardized units readily combine into a compact, integrated system matched to your requirements. Factory assembled and tested, they provide a degree of over-all co-ordination difficult to achieve in any other way.

Standardized "packaged" units include circuit breakers, associated switching equipments and interconnecting buses. Each has been given the large investment in design time and high degree of design refinement warranted by repetitive manufacture. All are completely metal enclosed and fully co-ordinated to assure greater safety and dependability.

For complete information concerning the many advantages of G-E station-type equipments, see your local G-E sales representative, or write the General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

Hot Line and Parallel Groove Clamp Taps on ACSR Conductors

A guide to installation of clamps; eight methods, with preferred and alternate installations used by Consumers Power Co

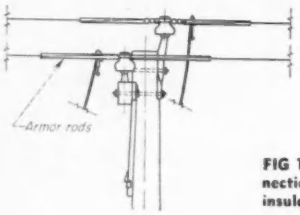


FIG 1—Hot line clamp connection over armor rods at insulator ties

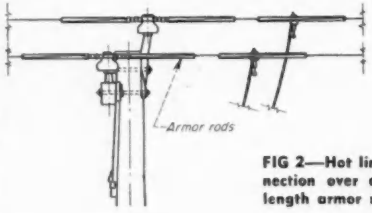


FIG 2—Hot line clamp connection over adjacent half length armor rods

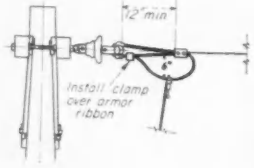


FIG 3—Hot line clamp connection to free end of conductor at dead end (Preferred installation)

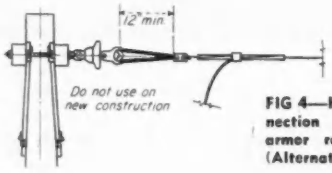


FIG 4—Hot line clamp connection over half length armor rods at dead end (Alternate installation)

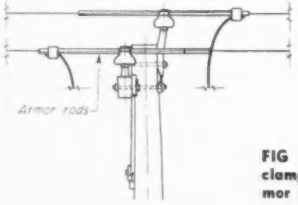


FIG 5 — Parallel groove clamp connection over armor rods at insulator ties

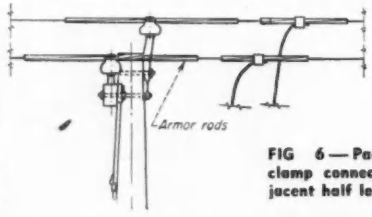


FIG 6 — Parallel groove clamp connection over adjacent half length rods

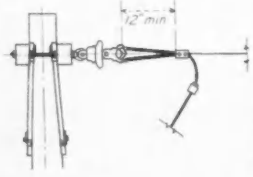


FIG 7 — Parallel groove clamp connection to free end of conductor at dead end (Preferred installation)

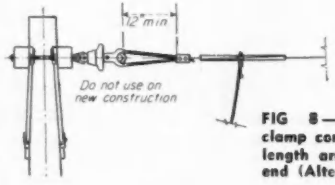
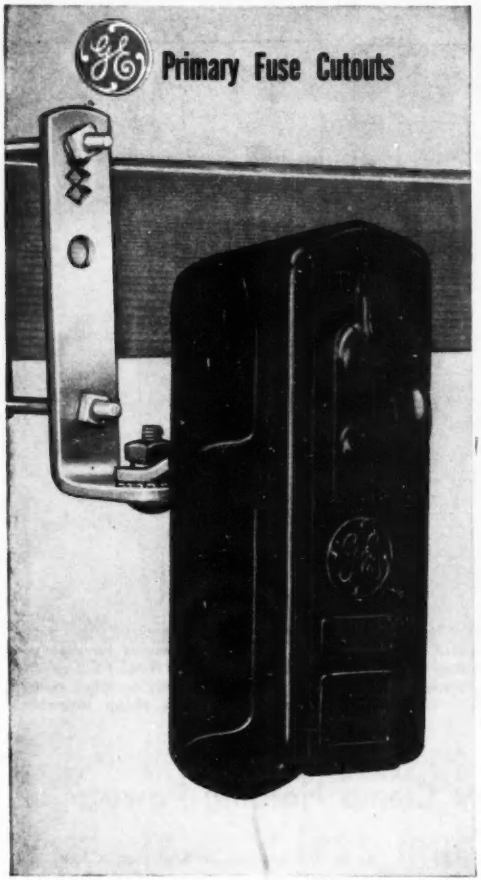


FIG 8 — Parallel groove clamp connection over half length armor rods at dead end (Alternate installation)

Notes

1. *Taps shall be avoided in telephone or railroad crossing spans where practicable*
2. *All clamps should be perfectly free from dirt before installing. The cable where the clamp is to be installed should be perfectly free from dirt and oxide. A wire brush should be used to clean the cable if necessary*
3. *Cable at the point where connection is to be made, as well as all contact and conducting surfaces of clamps, should be treated with a zinc chromate paste before installation*



This cutout is liberally designed—has high dielectric strength, uses silver-plated contacts, provides full-range interruption of fault currents, and is conservatively rated as to interrupting capacity. All live parts are completely enclosed for maximum safety.

4 CUTOUTS IN ONE

by simply changing doors

AND THAT'S ONLY HALF THE STORY! By stocking only three interchangeable doors which fit both 5.2 and 7.8 kv, 50-ampere housings, you get the 4 operating functions illustrated below—a total of eight essential cutout combinations! Available also in 100-ampere ratings, this unique flexibility reduces inventory and simplifies stocks.

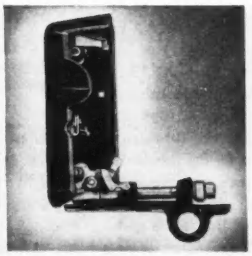
INDICATING OR DROPOUT WITH A TWIST OF THE WRIST! A small wire yoke, easily inserted or removed, determines whether the fuseholder door "kicks out" at the bottom for visual indication, or drops open—either way giving positive evidence of a blown fuse.

RECLOSING DOOR AVOIDS UNNECESSARY SERVICE TRIP! The two-element reclosing door restores service within one second after a temporary fault blows the first fuse link. By avoiding an extra service trip, the two-shot cutout pays for itself the first time it operates!

FLEXIBLE DISCONNECT BLADE CAN'T GET LOST! It's fastened to the door—can't be misplaced. This disconnect blade doubles the continuous current rating of the cutout. When the blade is disconnected and the door closed, the flexible cable extends downward to indicate that the circuit is open.

Only G.E. offers you this flexibility of cutout applications. For complete information contact your G-E sales representative, or write for Bulletin GEA-3448. *General Electric Co., Schenectady 5, New York.*

Indicating

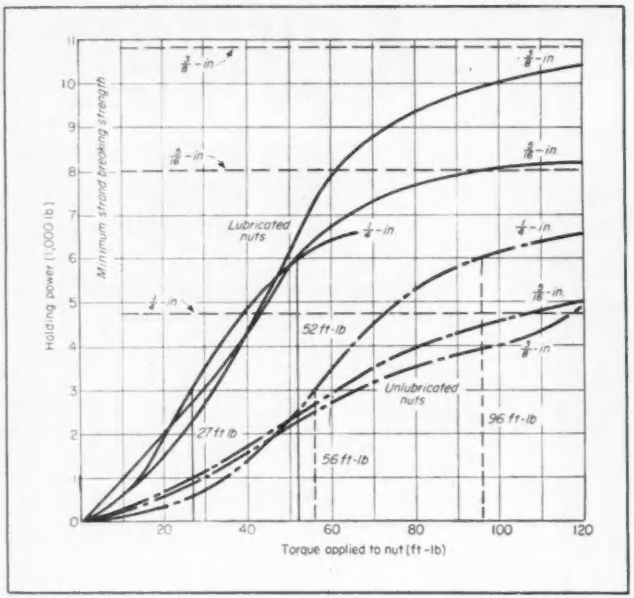

Drop-out

Reclosing

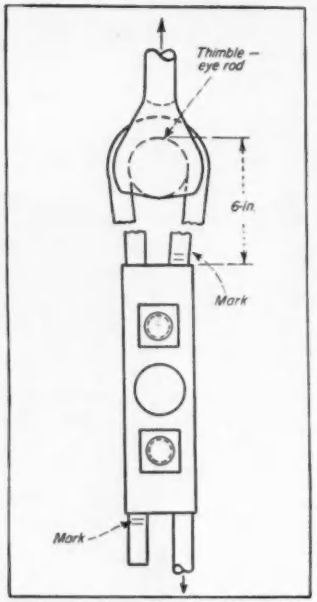
Disconnect

GENERAL ELECTRIC

406-39



TEST RUNS showed marked increase in holding power with lubricated nuts over non-lubricated nuts for same applied torque. Note that for holding power of 3,000 lb, a ¼-in. lubricated nut requires less than half the torque required by non-lubricated nut, and slightly more than half for 6,000-lb holding power



GUY STRAND was marked for slippage during holding power tests. Field conditions were simulated by including thimble eye in the guy clamp assembly

Lubricated Nuts Increase Guy Clamp Holding Power

C. W. PETERSEN
Design Engineer
Line Material Co
Milwaukee, Wisconsin

Application of a suitable lubricant to guy clamp nuts practically doubles clamp holding power for a given torque exerted in clamp installation. This was established by comprehensive tests on the holding power of clamps installed under various simulated field conditions.

In each test run a single torque value was applied to a single size of cable. Each run tested a minimum of three samples, each sample consisting of an unused clamp and cable with cables marked for slippage measurement.

To approximate line conditions, cable was looped over a standard ¾-in. thimble eye rod for pulling. Nuts were tightened equally with a torque wrench. The assembly was placed in a Riehle test machine and pull speed was maintained at a constant 0.4 in. per min. Marks for slippage measurements were in a position where only the actual measurement of the slippage of the cable through the clamp would be seen.

A sufficient number of runs were made on each size of cable, at torque values between 40 and 140 ft lb, to plot a "nut torque" vs "holding power" curve. To determine the effect of lubricating nuts, identical tests were made on clamps galvanized and with nuts lubricated, and on clamps galvanized and with nuts not lubricated. Results of six test runs on lubricated and non-lubricated nuts are illustrated in the accompanying chart.

Test results showed that for a given torque applied to nuts there was a marked increase in clamp holding power when nuts were lubricated. For a 3,000-lb load, ¼ in. high strength steel guy strand, torque required when nuts were lubricated was 27 ft-lb. With nuts not lubricated the torque required was 56 ft-lb. Similar results were obtained for a load of 6,000 lb. For this load a torque of 96 ft-lb was required when applied to nuts without lubrication, but a torque of only 52 ft-lb was necessary when applied to lubricated nuts. In a similar manner, while a 52 ft-lb torque applied to lubricated nuts would sustain a 6,000-lb load, the same torque of 52 ft-lb applied to nuts without lubrication would hold only 2,650 lb.

Test Conclusions

Other tests showed that holding power can be increased only 40 to 70% by installing a second guy clamp in series with the first. Based on these findings, and on the consistent holding powers of a single clamp when nuts are lubricated, it was concluded that only in extreme cases is it necessary to use two clamps. Equivalent results can be obtained with lubricated nuts and a single clamp. Result will be a marked reduction in cost and a saving of scarce materials.

The controls on all station-type feeder voltage regulators now meet rigid ASA Standards for Class I accuracy. This means they have an accuracy of at least 99%.

Induction Voltage Regulators require less maintenance

- **No contacts in the main circuit**
- **No cams or springs or elaborate gear trains**
- **No mechanical brake to adjust, no separate braking circuit**
- **Nothing to lubricate—complete operating mechanism (including the motor) immersed in oil**
- **Even the oil lasts longer—because the tank is sealed to stop all breathing**

And remember—G-E induction voltage regulators give accurate, stepless regulation of the highest quality obtainable. Rugged simplicity and the absence of time-delay makes them ideally suited for use on distribution circuits where loads are heavy, voltage variations are frequent, and prompt response to voltage change is essential.

Bulletin GEA-2985 gives full information. A copy can be secured from your G-E Apparatus Sales Office, or by writing *General Electric Company, Schenectady 5, N. Y.*

The General Electric IRS Induction Voltage Regulator has only three shafts, including that of the motor. All are mounted on enduring roller or ball bearings; all operate under oil. Wear is negligible. One gear train, a double-worm reduction, provides a drive that is simple, silent, self-locking and positive. There are no ratchets, no pawls, no chains to introduce uncertain operation and questionable life. No special braking circuits are used. The capacitor that gives the motor its high starting torque promptly throttles its rotation when the motor supply circuit is opened.

404-79

GENERAL ELECTRIC

Electrode Equipment For Welding Battery Equipment

ROBERT C. HUTTON
Mechanic, Substation Dept
Indiana & Michigan Electric Co.
South Bend, Ind

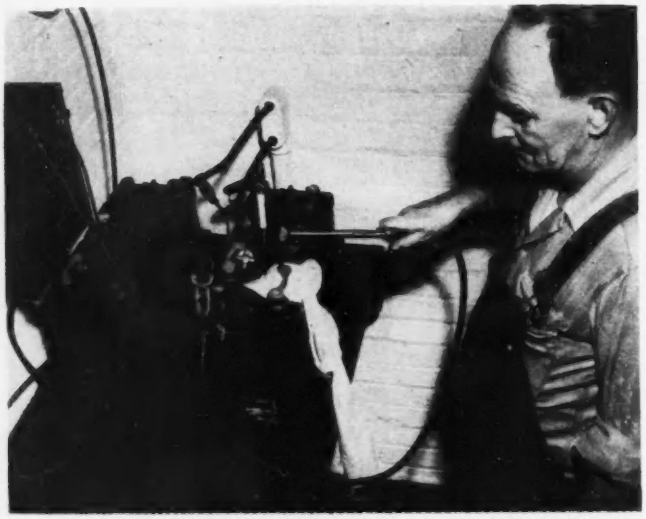
A carbon-electrode holder connected directly to one battery terminal has been used satisfactorily as illustrated for welding battery connectors. This method may also be used on emergencies to repair lead cable sheaths or for small brazing jobs.

The device has been used with Type KXOR-5 lead acid batteries and, we believe, can be used with equal success on other similarly constructed batteries. For best results in battery-connector installation, 4 v from 2 cells are used. This causes the carbon-electrode to glow a bright cherry-red after making contact. The carbon will attain lead-melting temperatures in a few seconds and the connector may be welded in two to five minutes, depending on the skill of the operator.

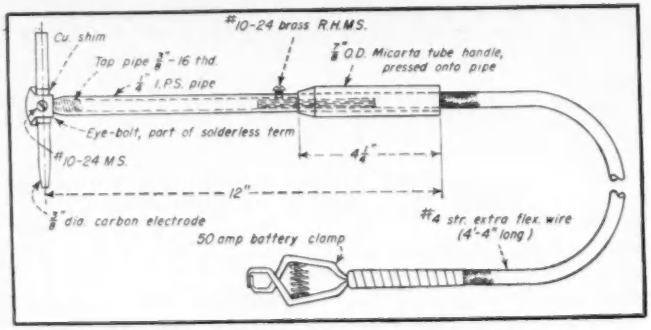
Consequently, the drain on the battery is quite small if properly used, so there is no danger of damaging the battery cells. Of course the battery cells supplying the power will be partially discharged after using this device, but the cells will recover with normal charging rates.

The usual precautions of packing wet cloth under and adjacent to the battery connector being welded, and removing the filler caps, should be observed. The locality of repairs must be kept well ventilated to eliminate the hazards of an explosive atmosphere. Care must be exercised not to use too small a battery as the source of power supply nor to maintain the welding current for too long.

For minor and emergency brazing jobs, 6 v (3 cells or a standard car battery) will cause the carbon electrode to glow at white heat. For such jobs using an auxiliary battery as the source of power for brazing, a second cable is necessary to provide the second polarity.



WELDING DEVICE for installing battery connectors; electrode, holder, cable, clamp



BATTERY CONNECTOR welded with carbon electrode and battery current

Power Winch Speeds Wire Salvage

RALPH W. SHAW
System Protection Engineer
Omaha Public Power District
Omaha, Nebraska

A power winch for wire salvage operations has been built by Omaha Public Power District to conserve manpower and to reclaim scarce copper. The unit will accommodate reels from the smallest used to those 72 in. in diameter. A collapsible reel is mounted on the end of the winch shaft. A variable speed pulley with a speed range of 15 to 45 rpm maintains a uniform winding rate for various sizes of drums. The unit is powered by a 3-hp, 3-phase, 220-v, 1,750-rpm motor.

In operation salvage wire or cable to be inspected or spliced is placed on a payout reel tended by one man and is pulled toward the operator. The winch is controlled by a foot-operated switch which must be held down at all times to maintain the motor circuit. This "dead man" feature will prevent the operator from being caught by the moving wire and drawn into the drum. A foot operated brake can be used to stop the drum rotation quickly when desired.

The unit has been used to salvage

Electric hands on hot spots warn of overheat danger

For Temperatures of:

- Generator Stator
- Generator Field
- Hydrogen Cooler
- Exciter
- Bearing Oil
- Bearing Metal
- Transformers
- Cables

When any overload, whether emergency or planned, pushes equipment past safe ratings, L&N instruments in thousands of plants warn operators against overheat damage.

Temperature Detectors. For temperatures of generator and synchronous condenser stators, motors and transformers, Thermohms —A.I.E.E. standard resistance thermometer elements—are built into the equipment during manufacture. Other types and sizes of Thermohms are mounted in cooling ducts, oil and water lines. The numerous L&N thermocouples for power equipment include a flexible, small-diameter design for bearings.

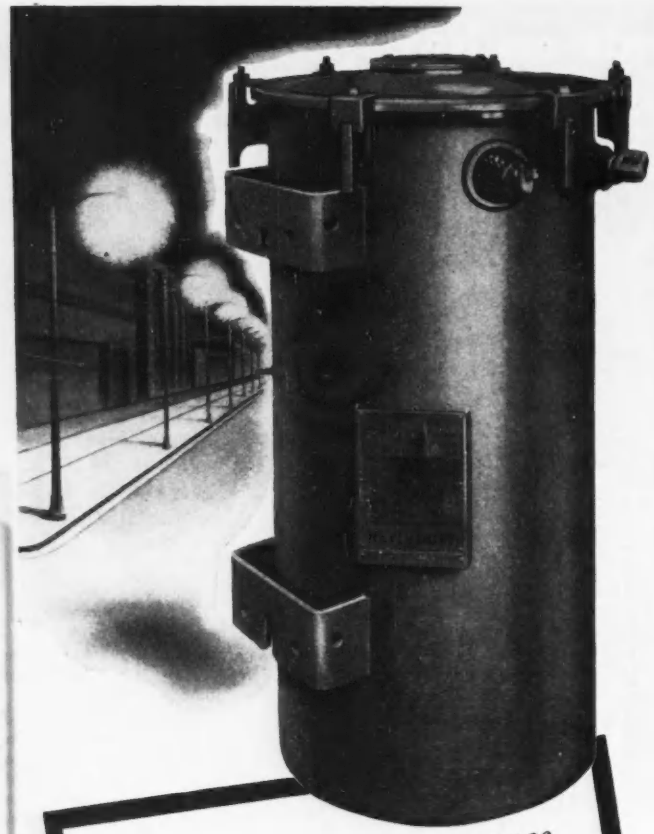
Instruments. Newest model is a Speedomax which checks through 160 separate temperature points in less than 11 minutes. This instrument records, indicates and signals in any desired combination; centralizes data and greatly reduces the labor involved in routine temperature monitoring. Other Speedomax models cover up to 16 points, at a rate of one every four seconds. Micromax instruments record up to 16 points, at a rate of one per minute. Single point Micromax is supplied for rotor temperature, with special calibration for the individual generator. Where automatic recording is not required, manual or automatic panel indicators can handle up to 96 Thermohms or 126 thermocouples.

All models come in standard ranges for power plant temperatures. Recorders can operate signals and alarms when temperature limits are reached, as required for the operating needs of the individual plant.

L&N Engineering Service. Through several decades of intensive experience with power plant applications, our staff of specialized engineers has worked with many major utilities on instrument problems. An L&N man will be glad to study your applications: just write to our nearest office. For a copy of our catalog, write to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.

LEEDS NORTHRUP

Jrl Ad ND4-33-461(1)



Street Lighting Maintenance
COSTS LESS
when you install HEVI DUTY Constant Current Regulators

LAMP life is substantially improved when Hevi Duty Static Type Constant Current Regulators are used, because the resonant circuit with exclusive patented feature eliminates high inrush currents. Lamp maintenance costs are reduced. Write for Bulletin CCR-478.

HEVI DUTY ELECTRIC COMPANY
HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

POWER WINCH conserves manpower and reclaims scarce copper.

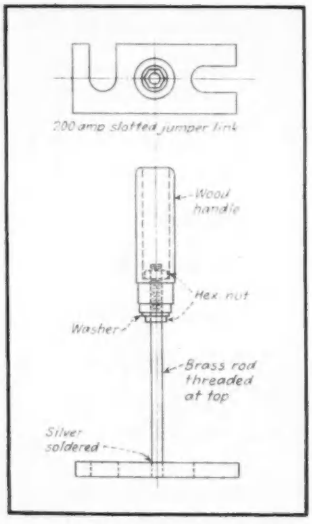
No. 6TBWP wire for use as service drops. Lengths of 20 ft or more are spliced together with sleeves which are then taped and painted. In nine minutes 150 lb of No. 6 wire can be wound on the collapsible reel.

Improved Jumper Link For 200-amp Test Blocks

J. G. MESSICK
Meterman "A"
Western Division
Ohio Power Co
Lima, Ohio

An improved test link facilitates attaching meter test clips and also reduces the possibility of short circuits.

(*Continued on page* 134)



JUMPER LINK soldered to handle aids in attaching test clips and reduces likelihood of short circuits

A REAL BARGAIN

figured in years per dollar

If you ask the question, "Will this station insulator fit my system standards?", the answer can be found quite easily, as industry specifications rigidly define measurable qualities.

What if you ask, "How many years will this station insulator give satisfactory service?". There is no ready answer to this question -- at least not until those years are up!

Be sure to distinguish between what *can* and what *can't* be specified when you purchase station insulators; likewise be sure to recognize that the thing you want most, and the thing that determines your money's worth -- performance -- is not subject to standards or specifications. That's why there can be such a big difference between makes of products in such a highly standardized field.

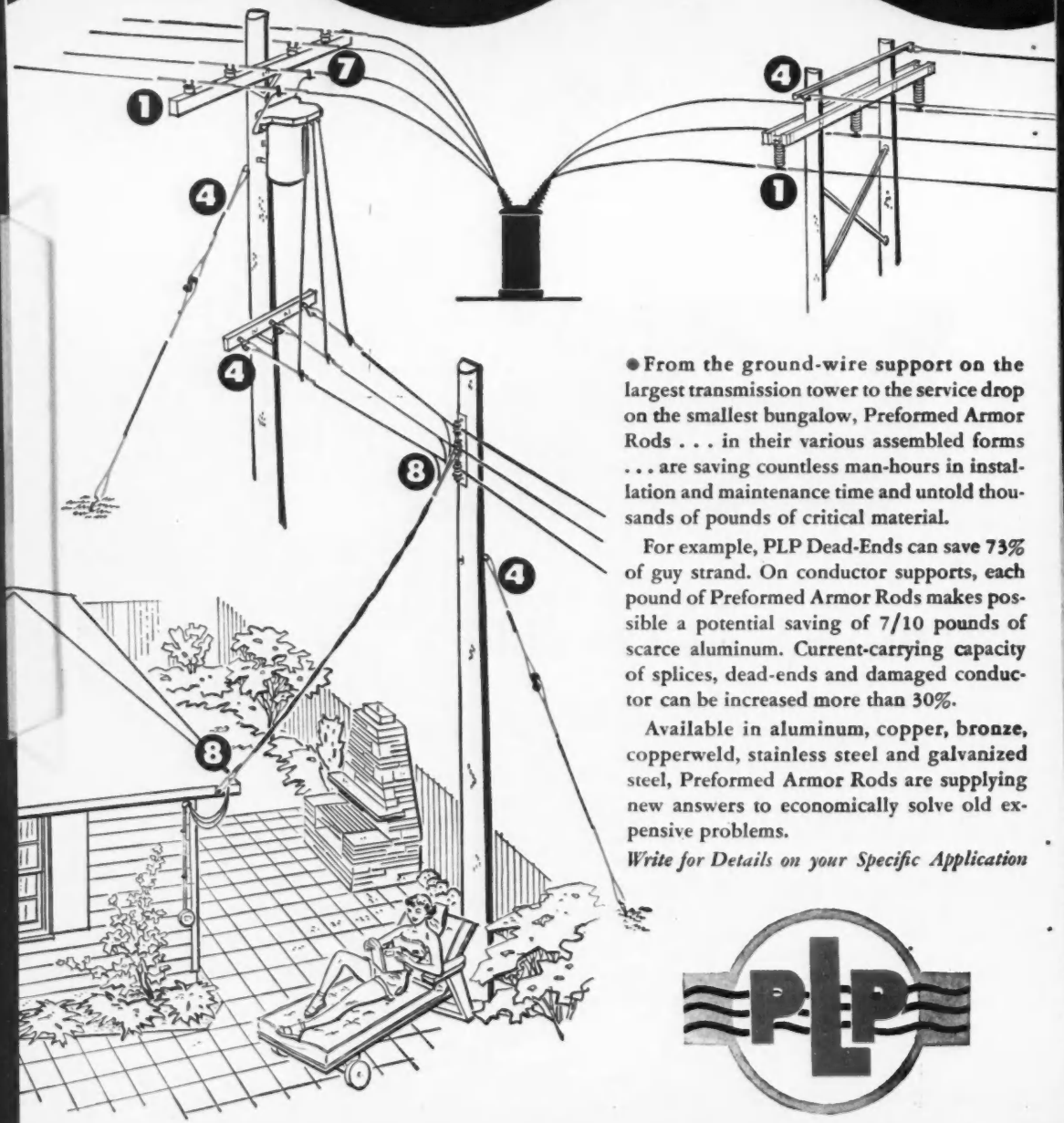
Most O-B station insulators are bought on repeat order, by companies that have *had* their chance to gauge their money's worth. For a genuine bargain, figured in years per dollar, insulate *your* stations with O-B.

Ohio Brass

MANSFIELD • OHIO

4130-H

"Preformed" MEANS SAVINGS



● From the ground-wire support on the largest transmission tower to the service drop on the smallest bungalow, Preformed Armor Rods . . . in their various assembled forms . . . are saving countless man-hours in installation and maintenance time and untold thousands of pounds of critical material.

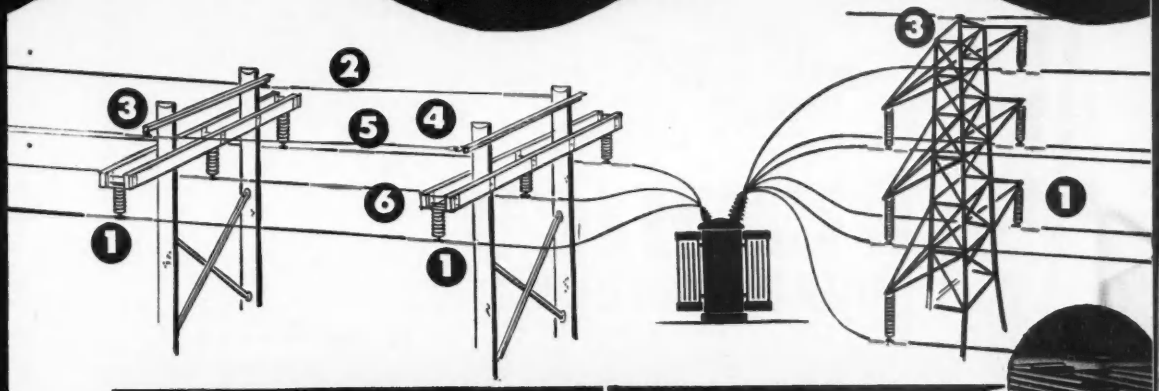
For example, PLP Dead-Ends can save 73% of guy strand. On conductor supports, each pound of Preformed Armor Rods makes possible a potential saving of 7/10 pounds of scarce aluminum. Current-carrying capacity of splices, dead-ends and damaged conductor can be increased more than 30%.

Available in aluminum, copper, bronze, copperweld, stainless steel and galvanized steel, Preformed Armor Rods are supplying new answers to economically solve old expensive problems.

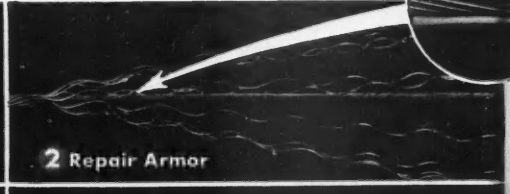
Write for Details on your Specific Application

PLP

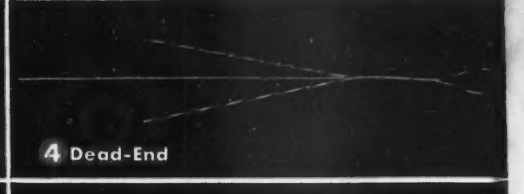
ALL ALONG THE LINE . . . . .

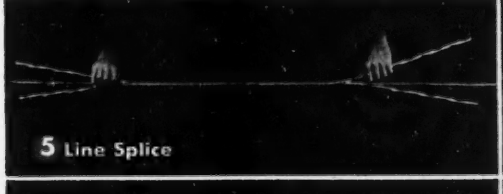


1 Support Armor


2 Repair Armor

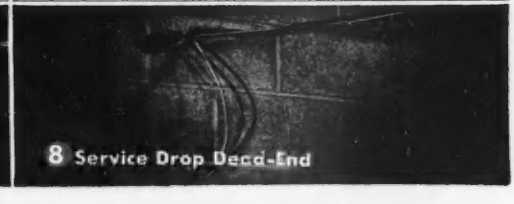
3 Strand Armor


4 Dead-End


5 Line Splice

6 Hot-Splice Shunt

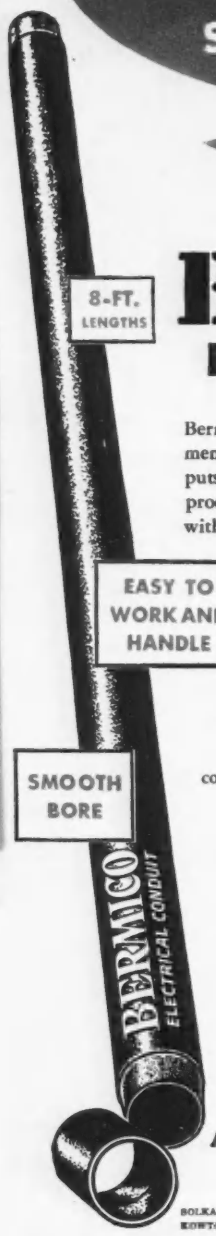
7 Hot-Line Tap


8 Service Drop Dead-End

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE CLEVELAND 3, OHIO

FOR CONDUIT *with the* STRENGTH BUILT-IN SPECIFY



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FIBRE CONDUIT!

Bermico has the strength to meet every conduit requirement – the all-around strength that only wood fibre puts into conduit! It is this tough, durable specially-processed fibre which makes Bermico better able to withstand excessive abuse and rough handling.

EASY TO WORK AND HANDLE

With Bermico you get **Easy Cable Pull.** Its unusually smooth bore prevents chafing or injury to cables being pulled through.

Bermico is **Easy to Work and Handle.** You can do cutting and tooling right on the job! Its 8-foot lengths are light . . . easy to install.

Bermico's **Complete Line of Bends,** plus angle couplings, enables you to meet unusual field conditions.

On your next construction job, use Bermico – the conduit with the strength built-in. It will give you extra years of trouble-free cable protection at lower cost.

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Improved Jumper Link

(*Continued from page* 130)

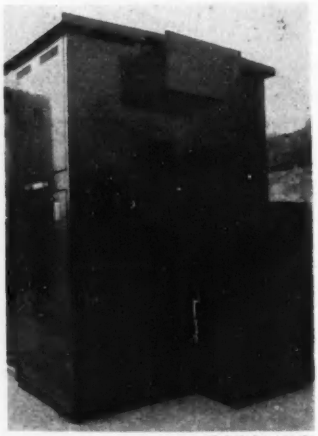
Test links are being provided with longer handles and with slotted instead of punched holes. This is the result of a suggestion to a manufacturer of a meter test block.

The improvement was necessitated with the advent of larger-capacity, single-phase and polyphase loads that could be metered by self-contained meters, and when our company began using 200-amp test blocks equipped with test links. With the modified design, the links are easily placed in the proper position without removing locking nuts entirely. There is less chance of a link swinging into the adjacent phase. Furthermore, potential test clips may be readily attached to the brass rods below the jumper handles. Test-current leads are clamped to the test block studs because of the currents involved.

Switches Streamline Primary Throwover

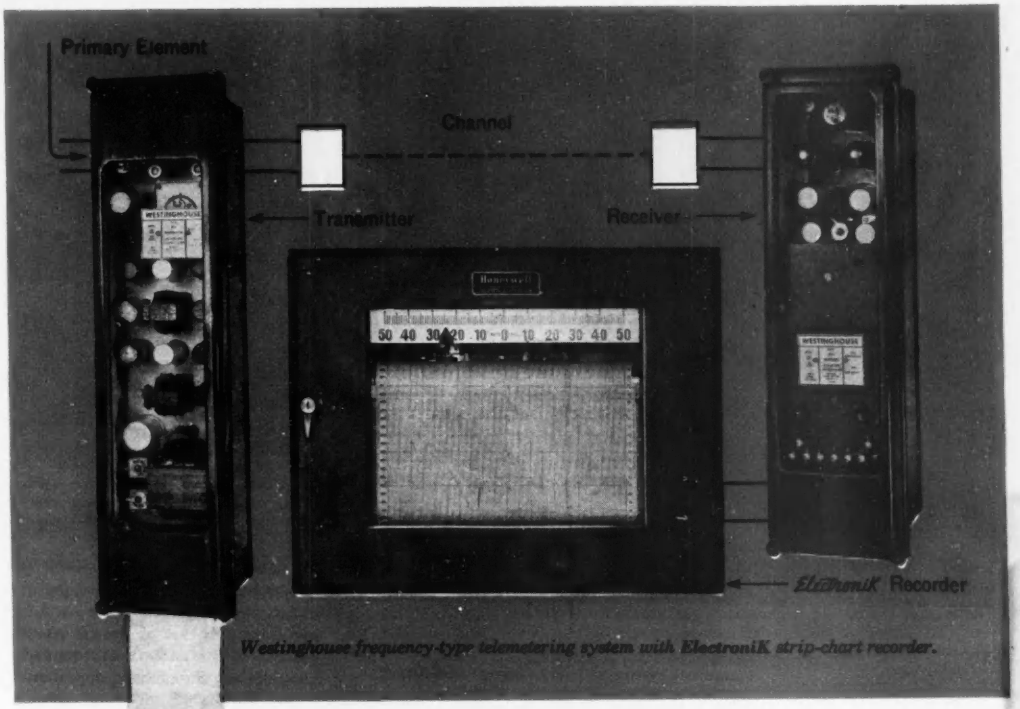
J. F. SINNOTT
Protection Engineer
San Diego Gas and Electric Co

Motor-operated circuit interruptor switches and transformer primary fuses have given San Diego Gas and Electric automatic primary throwover service at a comparatively low cost and mounting of the equipment in



S & C Electric Co

NEAT LOOK and low cost, compared to oil circuit breakers, are advantages of load interruptor switches installed in this outdoor metalclad switchgear



Westinghouse frequency-type telemetering system with ElectroniK strip-chart recorder.

ElectroniK RECORDER

now combined with

ADVANCED TELEMETERING SYSTEM

IN this system, an *ElectroniK* recorder assures rapid and accurate collection of all vital information at a central location in a matter of seconds. Non-cyclic, non-periodic, continuous telemetering action of the system is matched by the continuous balance of the *ElectroniK* recorder. As a result, *both* telemetering and recording are *continuous*, with no periodic electro-mechanical relaying or feeling motion in the accessory equipment.

The system comprises an arrangement capable of measuring, transmitting, receiving and recording any measurable variable that can be converted into an electrical quantity. It keeps the load dispatcher in constant touch with each station . . . helps him determine when to pick up or drop blocks of power, how well the outlying stations are maintaining their loads, and to keep up-to-date on the relation of his area to adjacent areas.

Details of this system, with drawings of single and multiple station telemetering, equipment required, etc., are all contained in Data Sheet No. 9.1-9. Write for your copy today.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell

Brown Instruments

The responsibility of public utilities to provide dependable service 24 hours a day is taken for granted by every customer who pays his bill. Only "acts of God" excuse the company for failure to do so.

Financially, a transformer fire is unimportant, but the resulting black-out of power and light service to homes, hospitals, defense plants and municipal properties may well prove tragic. Protect your customers by protecting your transformers with a

Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems, and Foam and Carbon Dioxide Extinguisher Systems.

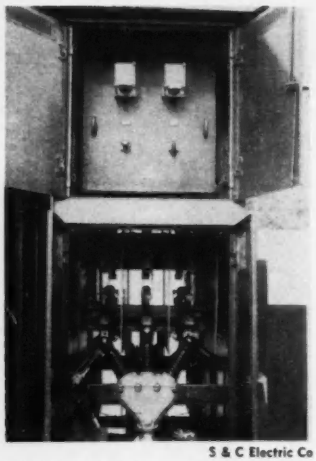
BLAW-KNOX
AUTOMATIC FOG SYSTEM

Through fast-acting rate-of-rise thermostats, any critically hot transformer is instantly blanketed with a heavy, quenching "fog" of water, confining the damage and protecting adjacent areas . . . materially reducing power failures in both frequency and extent. Without obligation Blaw-Knox engineers will survey your fire hazards, make a layout of the most efficient system and estimate costs. Blaw-Knox Fire Protection Systems carry the approval of all underwriters.

"LITTLE JOEY SPRINKLER"

BLAW-KNOX SPRINKLER DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY
829 Beaver Ave., N.S., Pittsburgh 33, Pa.
Offices in Principal Cities

BLAW-KNOX FIRE PROTECTION SYSTEMS



S & C Electric Co

BACK TO BACK mounting with shafts linked permits one motor to run spring-loaded switches. Fuses for short circuit duty are behind top panel

metalclad switchgear has solved an appearance problem. Cost of the installation is roughly between one-half and two-thirds that of two oil circuit breakers in conventional outdoor rack construction. Streamlined appearance of the metal clad enclosure matches the throat-connected transformer for an over-all unobtrusiveness; thus the installation satisfies zoning restrictions.

Basically the unit is nothing more than a pair of 600-amp, 15-kv, quick-make and quick-break, spring-loaded, motor-operated, load interruptor switches connecting two primary sources to a set of primary fuses. The fuses, which provide short circuit protection, feed a 1,000-kva, 4,330-v single-circuit unit substation transformer.

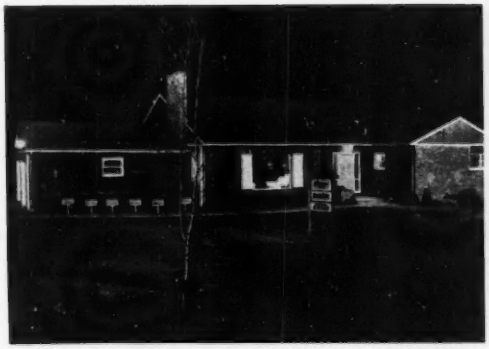
Switches are mounted back to back on one supporting structure. Their shafts are tied together, and motor and operating mechanism are mounted on the side of the enclosure, with an extension handle for hand operation. Two voltage relays and appropriate switching provide a preferred-emergency selection, with the connection returning to the preferred source 5 sec after voltage is restored following an interruption.

What did we learn from the big storm last fall? See the November 5 issue of Electrical World

4 examples: G-E Light Conditioning program now underway in a BIG way!

FEATURED AT HOME BUILDERS' SHOW. Most of the 40,000 people at this year's Atlanta exhibition saw the Georgia Power Company's Light Conditioning demonstration . . . one of the show's outstanding attractions.

SEEN BY THOUSANDS OF CLEVELANDERS. This home, one of 8 sponsored by the Cleveland Electric Illuminating Company, stayed open day and night; attracted thousands of home buyers interested in Light Conditioning.



ATTRACTED MORE THAN 12,000 VISITORS. People in the Metropolitan New York area flocked to see this Light Conditioned house in Closter, N. J. Recipes used included valance lighting in living room and dining room.

PRODUCED REQUESTS FOR 5000 RECIPE BOOKLETS. After seeing Boston Edison's model Light Conditioned living room, guests of the New England Home Show requested over 5000 Light Conditioning booklets.

ALMOST 100 electric service companies have already begun to tie in with General Electric's Home Light-Conditioning Program. More and more lighting equipment suppliers are promoting Light-Conditioning.

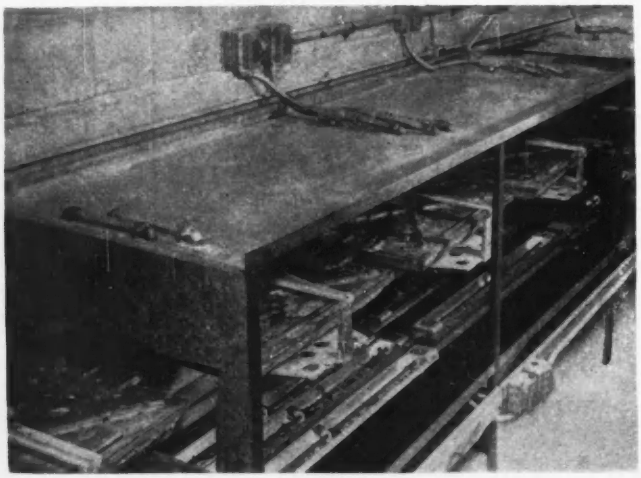
Nearly 2 million Light-Conditioning recipe booklets have been distributed. And millions of people have been seeing and reading General Electric's national advertising on Light-Conditioning.

Shown above are four typical examples of how the Light-Conditioning Program is being carried on. To learn how you can tie in, call your G-E Lamp District Office, or write Lamp Division, General Electric, Dept. 166-EW-10, Nela Park, Cleveland 12, Ohio.

You can put your confidence in—

GENERAL ELECTRIC

Infrared Ups Rubber Production 50%



FOAM RUBBER curing quality is improved and rejects cut in this 42 ft long oven having 30—1.8 kw radiant infrared heaters. Production is increased 50% over old hot water method. Input controllers keep the mold temperature within close limits

Production of latex foam sponge rubber at Lien Rubber Mfg. Company, Los Angeles, has been stepped up 50% by shifting from hot water to infrared heat for curing. Quality has also improved since the former method left water spots on the finished product, resulting in a large percentage of rejects. Delivery of 25 molds an hour or 400 a day on two 8-hr shifts is now accomplished, compared with the previous capacity of 16 molds an hour or 384 a day on three 8-hr shifts. The radiant heaters withstand rough handling and splashes of latex foam from passing molds.

With the infrared method the latex foam compound is poured into aluminum molds which are immediately conveyed through the zoned infrared oven. Thirty 1.8-kw electric radiant heaters are used in the installation.

The first zone provides rapid heating; the second zone adjusts the mold temperature to 200 F; the remaining zones maintain this required temperature. The heaters are distributed equally at top and bottom throughout the oven to assure uniform heating of molds. Input controllers are used to keep the mold temperature within the close limitations. After leaving the oven, the molds are water cooled to bring the temperature of the cured foam rubber down to about 70 F.

Record Battery Charging to Reduce Failures

BATTERY RECORD

Day Operator _____ Night Operator _____ Date _____

Battery Number	Charging										Put in Service			Returned			Remarks
	Started					Finished											
	Date	Time	Amps	Temp	S.G.	Date	Time	Amps	Temp	S.G.	Date	Time	Truck No.	Date	Time	S.G.	

CONVENIENT FORM for recording battery charging operations will aid industrial electric truck operators in eliminating premature storage battery failure

K. A. VAUGHN
Manager
Field Engineering
Gould Storage Battery Corp
Depew, N. Y.

Proper records of charging operations of storage batteries for industrial trucks is of primary importance for correct charging. The record form and procedure presented here will help to eliminate improper charging, the primary cause of premature storage battery failure.

First of all, each battery should be numbered. When batteries are brought in for charging, the operator should record the date, time, vehicle number, battery number and specific gravity and temperature of a pilot cell. This same information should be recorded when the storage battery is taken off charge.

Thus, a complete record of the battery characteristics is furnished which will indicate whether the battery is being correctly charged. For

example, if specific gravity is less than 1.260-1.280 at the end of the charge, the battery has been undercharged. If temperature is above 110 F, charging rate has been too high. If records indicate that the battery is being over or undercharged, the cause can be determined and corrected before work stoppages occur because of a failure of the battery.

Secondly, when records indicate over or undercharging, (1) the battery should be checked to see that all cells are functioning; (2) charging equipment should be checked for correct adjustment; and (3) instruments should be checked to see that they provide the correct indication.

Battery room foremen should be thoroughly familiar with storage battery technology and should be acquainted with the key points of charging equipment. Some battery manufacturers periodically conduct courses on these subjects to which battery maintenance men are invited. Battery manufacturers also maintain field engineering staffs to help solve battery problems at the users' plants. It is recommended they be consulted when problems arise. Early consultations may result in considerable savings.

Continental Radiant Glass Heating Corp.

CEMENT DRYING by a 650w radiant glass heating panel in machine which automatically applies and dries the cement on zipper fastener tape, saves 50% labor, requires only a quarter of the space and speeds the process five times faster than former manual method with air drying. Installation reduces burn hazard for operator

Radiant Heaters Speed Cement Drying

Lacquer cement drying of zipper fastener tape is five times faster and more uniform with electric radiant heat than with previous drying method at the Gem Slide Fastener Corp., New York City. A 650-w radiant glass heating panel is mounted vertically adjacent to a series of rollers which hold the tape and pass it through the completely automatic machine—saving 50% labor on the cementing operation and occupying only a quarter of the space formerly required. There is no delay or manual holding of the tape and no danger of burning or injury to the operators.

This time and labor saving machine was built in cooperation with Mark Kert of MEK Industries, New York.

INDUSTRIAL BRIEFS

Vinyl record heating (before pressing) by infrared lamps provides uniform heat, cuts losses, and eliminates sticking of records to table top (experienced with formerly-used steam table method) at King Records, Inc, Cincinnati, O. The vinyl material is heated on 175 F table and bank of twelve 250-w infrared lamps mounted 12 in. above table top provides 290-295 F at point 2 in. above table top. In 5 min material reaches proper working temperature without sticking to table. Total load of seven tables in use is 21-kw, operating 8 hr daily, 5 days a week. Pairs of 120-v lamps are connected in series and load balanced on 240 v, 3 phase. F. C. Neal, Power Engineer, Cincinnati Gas & Electric Co.

Bolt hardening costs have been cut 70% at the De Laval Steam Turbine Company, Trenton, N. J., according to S. P. Felix, supt of the company's Standard Products Division. This process also gives them correct hardness and distortion-free properties. "Lead time" on the hardening operation has been cut from three days to a few hours on a given batch. Formerly, the company had to heat furnaces for small runs, or hold jobs until enough pieces had accumulated to justify a run. This slowed down production and increased "lead time." Induction heating is said to be cooler, cleaner, and safer than the carburizing process it replaced. General Electric Co.

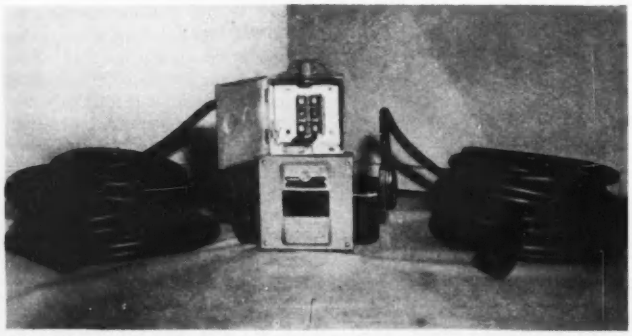
Motor-Driven Conveyor equipment speeds production at Sessions Clock Co, Forestville, Conn. Metal clock cases are press-fabricated from 1,000-lb coils, cleaned, bonderized and automatically sprayed and baked under 83 kw in infrared lamps. One conveyor about 250-ft long serves seven "bath" tanks holding 8,600 gal of solutions. In the final assembly room, streamlined conveyors facilitate turning out 16 units per min. Other conveyors then transport completed units to electrified test reels for "run-in" performance check-up, followed by conveyor service to shipping area. Conveyors total 12; are 788 ft in aggregate length and require 10.25 hp in motor drives.

SALES AND SERVICE

RESIDENTIAL • RURAL COMMERCIAL

Temporary Service For Range Demonstrations

MERRILL C. BOCK
District Appliance Serviceman
Indiana & Michigan Electric Co
Elkhart, Indiana



COMPACT UNIT provides temporary service for two units during electric range demonstrations. This portable outfit connects into a 115/230-v supply

A compact unit that requires minimum assembly or disassembly on the job has been developed to provide temporary service for electric range demonstrations. The outfit is safe, neat, adequate, and saves time. It was assembled by the merchandise service department of the company.

The assembly is suitable for connecting two ranges. It consists of a 6 x 6 x 4 in. terminal box, equipped with a 28IE general-purpose safety block, two 50-amp, 2-pole circuit breakers, and one 1¼ in. close nipple for joining the boxes, four range receptacles, two 50-ft, 3-conductor No. 6 type S cables, 3 ft of No 6 type T wire, 18 in. of bare No 6 wire. This portable outfit is connected to the 115/230-v service by an appliance serviceman. Cover of top box is labelled with the name of the electric power company.

Previously when electric-range demonstrations were made at places where proper service facilties were not available, it has been customary to provide temporary facilities by assembling a 100-amp fused switch, No 6 service-entrance cable, and range receptacles for each installation.

Fan Cooling Reduces Potato Storage Losses

LOWELL D. OVERMYER
Agricultural Engineer
The Dayton Power & Light Co
Dayton, Ohio

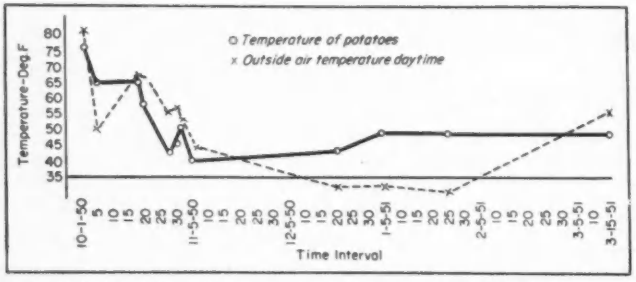
Loss resulting from sprouting has been practically eliminated in the potato storage building of Paul Jordan & Sons, New Paris, Ohio. The first year the building—52 x 120 ft, holding 60,000 bu—was filled, the sprouting loss was almost 10%. It was suggested that a flue and duct system similar to that used for hay curing would reduce this loss. It did, and in a most effective manner.

The fan selected was a 42-in., propellor type, powered by a 7½-hp motor and delivering approximately 30,000 cfm at one quarter inch static pressure (water), ½ cfm per bushel of storage capacity. An intake flue was provided to the fan from above the potato pile in order to permit recirculation in freezing weather to equalize internal temperatures and eliminate cold spots in the pile.

Periodic observations were made to determine the correctness of these recommendations. Data recorded included air temperature at intake, exhaust, and in the pile, static pressure and power consumption over the entire season.

The fan was operated at night when the outside temperature was below that of the potatoes which was lowered as much as 15 F overnight. At the same time, the higher relative humidity of the night air helped to avoid drying the potatoes rather than just cooling them.

Storage was filled fast, and the building was almost half full before the fan was operated. Because the outside air was so warm at first very



AFTER STORAGE WAS FILLED, temperature of potatoes was held at optimum level

Here's Why You Get Extra Service with VICTOR TRANSMISSION PINTYPES

VICTOR Transmission Pintypes give extra long life because they're designed for severe service and made to rigid specifications. Each is thoroughly inspected at every point of manufacture. Performance data proves they furnish years of trouble-free service! Choose VICTOR—the finest insulators skilled craftsmen and modern methods can produce!

V UNEQUALLED STRENGTH! VICTOR'S de-airing process produces porcelain of maximum density, strength and resistance to impact.

V CUSHION COATED JOINTS absorb thermal variations and mechanical shock.

V SMOOTH, HARD GLAZE protects against weathering and contamination, assists self-cleaning, reduces maintenance and replacement costs.

VICTOR NO. 245 TRANSMISSION PINTYPE INSULATOR. For complete engineering data on this insulator and other sizes and types, write today for Bulletin No. 4.

V LARGE RADIUS TOP AND SIDE WIRE GROOVES make hot-tying quick and easy.

V QUALITY CONTROL! All shipments of flint, feldspar, and clay are stored in separate bins and tested for quality and purity before use.

V CONTROLLED TESTING and PROCESSING of cement assure highest bond strength at assembly joints.

V HIGHEST QUALITY WET PROCESS PORCELAIN gives unexcelled dielectric and mechanical characteristics.

Do You Know that...

VICTOR carries a complete line of transmission and distribution line hardware. These high quality products include aluminum, forged steel and malleable iron strain and suspension clamps as well as arcing horns, yoke sets and other allied fittings.

Specify VICTOR TRANSMISSION PINTYPES

VICTOR INSULATORS, INC. VICTOR, N. Y.

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

little use of the fan was possible until the building was filled. When several good cool nights occurred in succession, the temperature inside fell quite rapidly. There was a rather rapid rise in temperature when the fan was operated in the daytime, but the potatoes were down to 42 F after 24 hr of fan operation with 42 F outside air temperature. After November 5, 1950, all fan operation was limited to circulation within the storage. No outside air was introduced.

Primary consideration was uniform cooling for control of sprouts. But as soon as digging started it was discovered that an infestation of late blight was going to cause some trouble with rotted potatoes. Cooling quickly to below 50 F was recommended as a means of retarding the spread of rot. This was done by the forced ventilation. If a potato was infected it was lost, but the air movement dried up the shell and prevented any spreading. On the top of the pile, where the humidity was highest, more spoilage occurred. There was more loss in those potatoes that were in storage for about two weeks before forced ventilation was applied.

Jordan reported that in previous years, sprouts up to a foot long, and between 5% and 10% shrinkage occurred by the middle of December. With ventilation, sprouts did not appear until late January and then only in one section where more mud had been carried in on the potatoes. Final grading was done on March 15. By that time sprouts about one half inch long had started but no shrinkage occurred.

Consumption of power clearly indicated how the fan was operated. About half of the total usage was required for cooling at digging time and the rest for circulation to hold a steady temperature. The total consumption was 1,208 kwhr, an average of but 0.02 kwhr per bushel.

At the end of the first year's experience observations indicate the following recommendations:

1. Minimum fan size should be based on one quarter cfm per bushel.

2. Design pressure should be 0.20 of an inch static pressure (water).

3. Outside air used for cooling but an intake flue for recirculation within the storage is necessary. This not only maintains an even temperature within the pile, but holds condensation to a minimum.

4. Free circulation above the pile during the cooling process is necessary to remove excess heat. Exhaust fans will assist in this but are not essential.

5. Generous use of the fan during harvest, any time the outside air is between 35 F and 50 F, will help prevent rot from spreading.

6. Temperature control during December and January is most effective for stopping sprouts.

Experience with this installation indicates that power costs for forced ventilation can be expected to range below ¼¢ per bushel, and that cost of an installation will range from one to three cents per bushel of storage capacity.

Weep No More

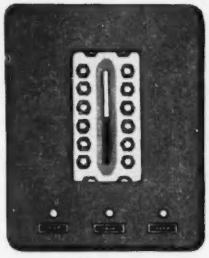
Would you like to stop crying about the high cost of food?

We know how.

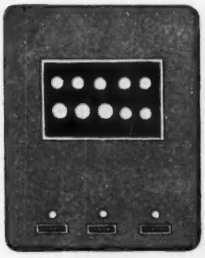
Call for a Commercial Cooking Consultant at
THE HARTFORD ELECTRIC LIGHT CO.
266 PEARL ST., HARTFORD, CONN., TELEPHONE 2-0131

REDUCTION OF COOKING SHRINKAGE is probably the good news that Hartford Electric Light's representative brings to the food service operators who reply to this

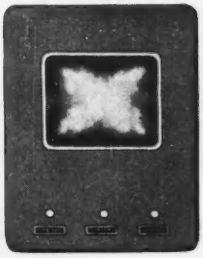
Rapidly Growing LIST OF UTILITIES Using the DIAMOND "UTILISCOPE" (WIRED TELEVISION)



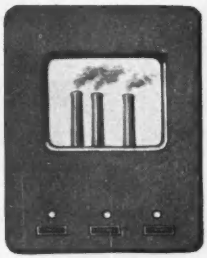
Boiler water level observation



Burner pilot observation



Boiler furnace combustion observation



Stack smoke discharge observation

Utilities listed below have purchased the Diamond "Utiliscope" for one or more of the uses shown. Images are brought to the boiler control panel where the operator can see them at all times.

***Ohio Power Co.**
Tidd Station

***Consolidated Edison Co.**
Hellgate Station
Hudson Avenue Station
Waterside Station
East River Station

***Commonwealth Edison Co.**
Fisk Street Station
Ridgeland Station

***Board of Water & Electric Light Comm.**
Ottawa Station,
Lansing, Mich.

***Cincinnati Gas & Electric Co.**
Miami Fort Station
Clermont Station

***Illinois Power Co.**
Wood River Station

***Oklahoma Gas & Electric Co.**
Mustang Station

***Indiana & Michigan Electric Co.**
Twin Branch Station
Tanners Creek Station

***Appalachian Electric Power Co.**
Phillip Sporn Station
Kanawha Station

***Northern Indiana Public Service Co.**
Michigan City Station

Public Service Co. of Indiana
Noblesville Station

Union Electric Power Co.
Venice Station

Northern States Power Co.
Minneapolis Station

***Dayton Power & Light Co.**
Hutchings Station

Buffalo-Niagara Electric Corp.
Huntley Station

***Duke Power Co.**
Dan River Station
Lee Station
Riverbend Station

Union Electric Co. of Missouri
Meramac Station

Elecktricitateetssakskabet
Kydnby Power Station
Isefyordraerkat,
Denmark

The "Utiliscope" is simple, stable, remarkably durable. It requires no technical skill for operation. Cost is low and is quickly amortized by labor saving and improved operation. Write for Bulletin 1025.

***Niagara Mohawk Power Corp.**
Dunkirk Station
Oswego Station
Huntley Station

***Societa Edison—Centrale diGenova**
Genova, Italy
Piacenza, Italy

Central Hudson Gas & Electric Corp.
Denskammer Station

***Tennessee Valley Authority**
Johnsonville Steam Plant
Widows Creek Plant

Chicago District Electric Generating Corp.
State Line Station

Public Service Co. of Northern Illinois
Station No. 6

Kansas Gas & Electric Co.
Murray Hill Station

***Long Island Lighting Co.**
Port Jefferson Station
Far Rockaway Station
Glenwood Landing Station

Toledo Edison Co.
Acme Station

Philadelphia Electric Co.
Delaware Station

Cleveland Electric Illuminating Co.
Eastlake Plant

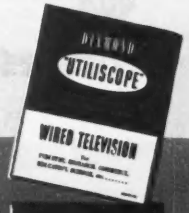
Indianapolis Power & Light Co.
White River Station

Virginia Electric Power Co.
Chesterfield Station

***Southern California Edison Co.**
Etiwanda Station

Repeat orders have been received from these utilities.

"UTILISCOPE" REGISTERED U. S. PATENT OFFICE



DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO • OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited — Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment For Industry

WRITE FOR BULLETIN 1025

NOTHING PERFORMS BETTER WITH ALUMINUM CONDUCTORS THAN

CAST ALUMINUM

Our Products are Quality Controlled from Ingot to Finished Product
POWER SUBSTATION CONNECTORS AND FITTINGS
TRANSMISSION SYSTEM CLAMPS AND CONNECTORS
DISTRIBUTION SYSTEM CONNECTORS AND ACCESSORIES

● Backed by many years of coordinated electrical, mechanical and metallurgical knowledge and experience in the design and manufacture of cast aluminum electrical products.

Consult one of our nearest 18 representatives or contact our main office.

ANDERSON BRASS WORKS, Inc.
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BIRMINGHAM, 1, ALABAMA

● BRONZE AND ALUMINUM POWER CONNECTORS, FITTINGS, AND BUS SUPPORTS
ALUMINUM SUSPENSION AND STRAIN CLAMPS

Sales and Service Notes

● Today's television prices—cuts recently announced by leading makers—are forced prices and not realistic in relation to the intrinsic value of the merchandise offered, according to Du Mont's sales manager, Walter Stickel. He blamed the present price slump on over-production, on confusion regarding materials restrictions, on local "buyers' strikes," and on heavy dealer inventories of appliances.

● A $1,000,000 promotion running through September, October, and November is in progress on the Westinghouse Laundromat and clothes dryer. The first-month program featured both appliances, the second centers on the automatic washer alone, and the third on the clothes dryer. Additional to national magazine, local newspaper and television advertising, the promotion includes, among a complete set of dealer helps, a new "Demonstrate-to-Sell" 16-page booklet on how to increase store traffic and obtain prospects.

● Sometimes a heavy appliance—refrigerator, freezer, or the like—goes into an older home where the floor may not be any too strong right where it is desired to set the new purchase. As an alternative to a carpenter job to strengthen the floor, there is available an adjustable steel x-brace easily installed between the joists. The maker is the Glover Manufacturing and Sales Co, Akron 14, Ohio.

● Promotion of electric housewares as gifts, started last spring, has been given a second push directed toward holiday buying. A revised plan book containing sales ideas and describing display kits available has been mailed by the Electric Housewares Section of NEMA to 5,000 selected dealers, to electric leagues, to members of the National Association of Electrical Distributors, and to others interested. Some 25,000 display kits were sold at the start of the promotion earlier in the year.

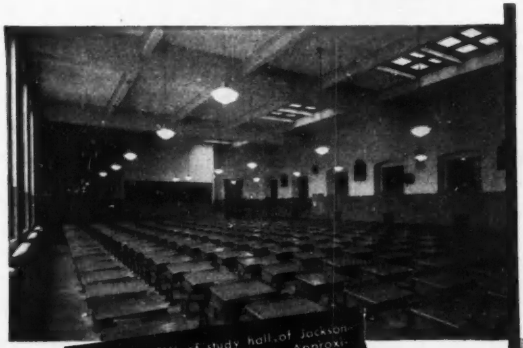
● Chicago's Lighting Institute has announced plans for fall quarter courses in lighting salesmanship, residential lighting, wiring design, lighting fundamentals, and artificial light in amateur photography. Class schedules extend from early October to mid-December. Courses are designed for electric utility and manufacturer lighting engineers and lighting salesmen.

Another Fine Lighting Job

SUPPORTED BY

UNISTRUT®

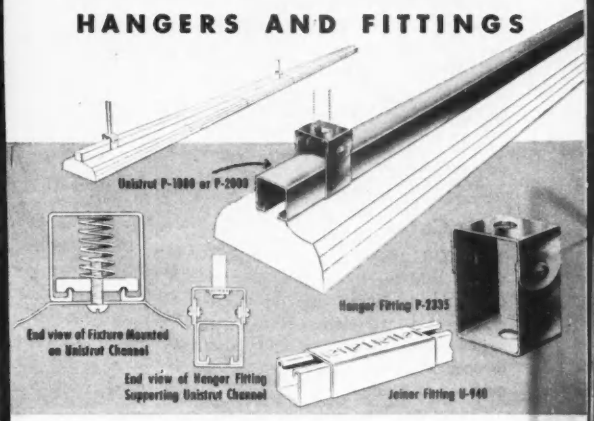
HANGERS AND FITTINGS



BEFORE VIEW of study hall of Jackson High School, Jackson, Michigan. Approximately 49 ft. by 83 ft. with 20 ft. ceiling. Twenty-one 16 in. opal glassware chain suspension fixtures with 200-watt lamps. Fixtures suspended 10 ft. above floor. Average illumination was 5 to 8 foot-candles.

AFTER VIEW of same study hall showing 4-lamp 40-watt fluorescent fixtures in continuous rows completely supported with Unistrut P-2000 channel and suspended 13 ft. above floor with ½ in. conduit stems, canopies and Unistrut Hanger Fitting P-2335. Average maintained foot-candles is 35-40.

Lighting recommendations by and photographs courtesy of Consumers Power Company, Jackson, Michigan.


Unistrut P-1000 or P-2000
Hanger Fitting P-2335
End view of Fixture Mounted on Unistrut Channel
End view of Hanger Fitting Supporting Unistrut Channel
Joiner Fitting U-940

THE COMPLETELY MODERN METHOD of Hanging Fluorescent Fixtures gives you these Exclusive Advantages:

FEWER HANGER STEMS AND CANOPIES UNISTRUT'S great channel strength permits wider spacing of stems—up to 15 feet apart if desired—for better appearing installation and obvious savings.

PERFECT ALIGNMENT—UNISTRUT channel is rigid, strong and perfectly straight—gives you true alignment of fixtures. Cleaning, re-lamping, or other servicing cannot disturb this alignment.

COMPLETELY FLEXIBLE—Stems or rods can be installed at any point along UNISTRUT channel. Overcomes possible ceiling irregularities or obstructions. Ideal for continuous runs or intermittent spacing of fixtures.

FASTER, EASIER INSTALLATION—UNISTRUT channel and fittings are attached to fixtures quickly and easily at normal working height or at suspension level. No drilling, no welding, 100% adjustable.

ADDED SAFETY—UNISTRUT assures the utmost safety of installation because an entire row of fixtures becomes a single integrated unit—added safety obtained by no other method.

SAVES TIME AND MONEY—Reduces number of canopy and stem sets used, lowers wiring and rewiring costs, eliminates drilling and welding costs, saves planning and installation time.

UNISTRUT APPROVED AS WIREWAY—UNISTRUT channel has been approved as a wireway by the department of electrical inspection in Chicago and 20 major cities throughout the country . . . additional proof of the versatility and all around practical usefulness of UNISTRUT.

WRITE TODAY FOR YOUR FREE COPY OF NEW 78-PAGE CATALOG 700!

U. S. Patent Numbers
2327587 2329815 2345650
2363382 2380379 2405631
2541908 Other Patents Pending

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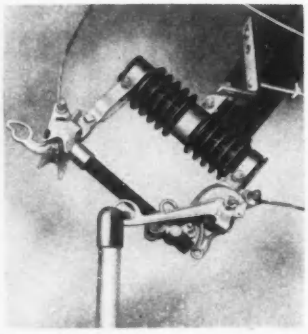
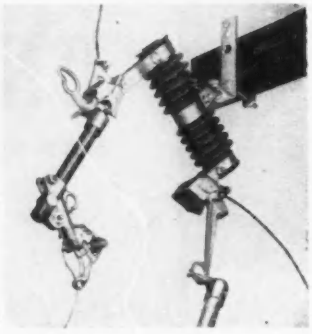
NEW EQUIPMENT





Fuse Cutout

The KO-L fuse cutout is equipped with a load break lever to interrupt circuit inside cutout fuse tube. Operating this lever with a disconnect switch breaks fuse link causing cutout to open as if fuse were blown by an overload or fault.

Cutout may be used to break charging, magnetizing and load currents.

When blown by overload or fault current this new coutout opens by kicking out at the bottom making possible a mechanical time-delayed contact separation. Link ejection is completed and arc extinguished in the tube before the contacts part—preventing contact pitting.

Load break device is optional.

A. B. Chance Co, Centralia, Missouri.

DC Armature Winding-Insulation Tester

This new dc winding-insulation tester will detect and aid in locating faults in turn-to-turn, coil-to-coil, and winding-to-ground insulation in dc armatures, series field coils, and low impedance ac stator coils.

Unit is designed for testing large motors and generators such as those in railroad, marine, steel industries.

The tester consists of a repeating type, surge-voltage generator which operates 60 times a second and a cathode ray oscilloscope. Operator checks scope to see if surge wave is of proper shape and amplitude. Any variation indicates an armature fault.

The heart of the new device, the surge generator consists of a 0.5 mf capacitor which is charged in one half cycle and discharged in the next half cycle through a pair of ignitron rectifiers connected back to back.

Coaxial cables conduct the surge to the commutator contact fixture.

Voltage on the capacitor is adjustable in two percent steps up to a 7500 volt peak by means of two tap switches and an autotransformer.

General Electric Co, Schenectady

•

Splicing Tools

Two compact hand Hytools have been designed to install Hysplices for a wide range of conductors used in overhead lines.

The new Burndy Hytools MD2-10 & MD2-12 are crimp type.

The MD2-10 is shipped with crimping grooves in position to install Hysplices on number 2-6/1 and number 4-7/1 ACSR. Reversing the jaws provides grooves for number 4-6/1 ACSR.

Hytool MD2-21 is shipped ready to install Hysplices on 8A and 6A Copperweld-Copper conductors. In the reverse position the jaws provide grooves for number 2-7/1 ACSR.

Limit stops control crimp.

Burndy Engineering Co, 107 Bruckner Blvd, New York 54, N. Y.

•

Distribution Panelboard

Distributor stocking and off-the-shelf delivery of circuit breaker distribution panel boards is now possible with a new type MHP panelette.

Standard 120 and 240 volt ac breakers are simply plugged onto silvered bus bars to complete the desired circuit arrangement.

Thermal-magnetic circuit breakers hold monetary overloads but trip if overload continues. Magnetic trip element functions instantly on both moderate and heavy "shorts."

Square D Co, 6060 Rivard St, Detroit 11, Mich.

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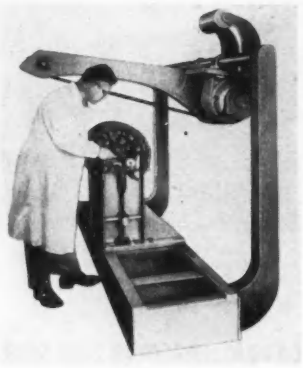


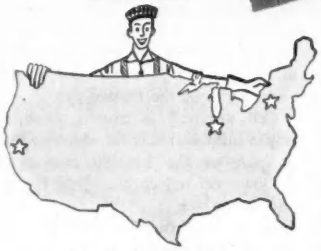
Dynamic Balancer

Armature, rotor, pulley, flywheel etc. to be balanced is placed on the Universal Dynamic Balancer with shafts resting on ball-bearing rollers and rotated to determine position

Serving the nation

from 3 great factories

through a nationwide distribution network



Hubbard products are carried in stock by more than 200 leading electrical jobbers throughout the United States. There's one near you.

Hubbard and Company began the manufacture of Pole Line Hardware when the Electrical Industry was in its infancy, and its growth has paralleled that of the power and communication systems.

Today three great plants, strategically located in Pittsburgh, Chicago, and Oakland, California, manufacture over 4000 items which are distributed to customers in 48 states and many foreign countries.

With confidence in the future of the industries which it serves and in the future of our nation, Hubbard continues its program of constantly expanded facilities and services.

HUBBARD AND COMPANY

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

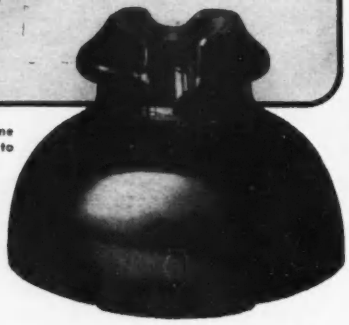
"Hang the Load on Hubbard Hardware!"

Illinois Porcelain Insulators ARE BUILT TO LAST...

Installed in 1928
STILL GOING STRONG
"Long Life" Illinois Porcelain Insulators which will provide dependable service for many years to come.

Right: Illinois Pin Type Distribution Line Insulator—one of many styles to meet all requirements.

Below: Typical Illinois Suspension Type Dead End Insulator.



● All Illinois Porcelain Insulators are designed and produced to exacting electrical and mechanical standards — completely tested and inspected to insure against breakdown on the job. This, plus a proved record in countless installations like the one shown above are your assurance of long years of thoroughly dependable service.

WRITE FOR COMPLETE INFORMATION AND PRICES

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

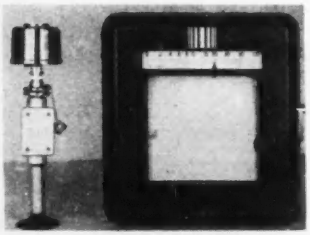
of dynamic unbalance. Corrective weights are then added.

Driving mechanism consists of an arm with a set of five-belts driven by a 5 hp motor. Balanced to stay in up position normally, it is lowered until the belts touch the equipment to be rotated.

Equipment up to 48 inches in diameter, 4000 lbs, and 80 inches between vertical standards can be balanced.

Industrial Engineering Equipment Co, 122 East Fourth St, Davenport, Iowa.

•



Daylight Illuminometer

For use in weather observation, power load predicting, test of paints and textiles, and similar outdoor exposure tests the Speedomax Daylight Illuminometer provides an automatic means of recording instantaneous values of daylight intensity.

Direct reading in foot-candles, the equipment consists of an L&N Illuminometer Cell of the photo-electric type and a speedomax recorder.

When precise measurement is desired, the user may calibrate the cell and recorder together with a standard light source. An integral filter modifies the photocell spectral response so that it corresponds to the mean visibility curve of the human eye.

Cell assembly is usually mounted atop a mast and is constructed so that no part of the housing can cause shadows or reflections upon its receiving surface.

Leeds & Northrup Co, 4907 Stenton Avenue, Philadelphia 44, Pa.

•

Hoisting Tower

A new Waco Material Hoisting Tower is available as either a double-well or single-well unit. Tower can be erected in approximately 2½ hours by three men.

Features include a "slow-up" brake on power mechanism to govern de-

THE
CONVENIENCE
OF

Uptegraff DRY TYPE Transformers

Saves money and Time for You!

Because Uptegraff Dry Type Transformers are safe to install anywhere and are light in weight, they do not require special rooms, enclosures, heavy foundations or floor supports. Initial cost is low, installation is relatively simple. Long, expensive bus runs are avoided because they can be located at or near the load center.

Uptegraff Dry Type Transformers are dependable and economical in service. The range of sizes includes transformers up to 2000 KVA, 3 phase, 15,000 volts.

The Uptegraff Unit Substation

R. E. UPTEGRAFF
MANUFACTURING CO.
Scottdale, Pennsylvania

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Top Quality

No. 201-NE

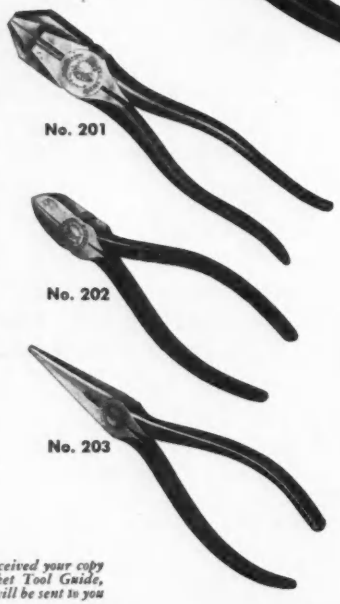
"Since 1857"

When it comes to judging the worth of pliers, ask the man who uses them every day. He'll tell you Kleins—for their hand fit—their proper balance—their carefully matched knives that stay keen longer.

The same top quality that typifies Klein pliers is also characteristic of other Klein tools and equipment—safety straps and belts, climbers, grips and wrenches. Men who know good tools have been choosing Kleins since 1857.

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp.
New York



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No. 203

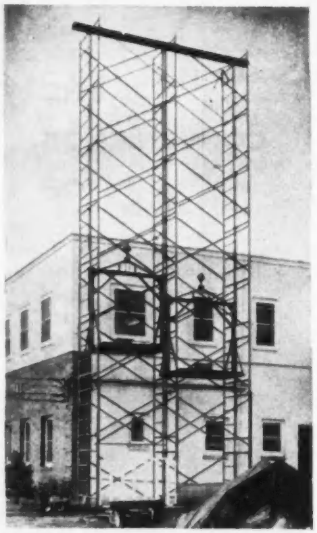
If you have not received your copy of the Klein Pocket Tool Guide, write for one. It will be sent to you without obligation.

Since 1857

Mathias KLEIN & Sons

Established 1857 — Chicago, Ill., U.S.A.

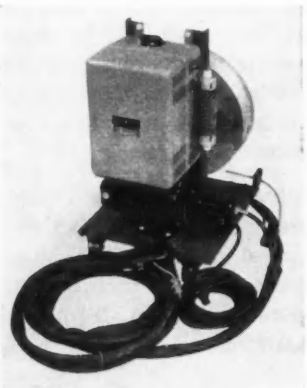
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS



scending speed and a safety slack brake which sets automatically in case of failure in the hoisting rig.

Powered by interchangeable gasoline or electric power units with hoisting speeds of 100 to 110 feet per minute, respectively, each tower has a capacity of 1000 pounds.

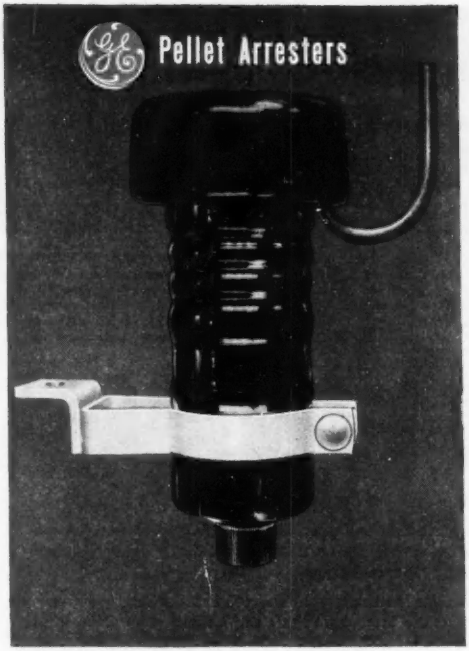
Wilson-Abrecht Co, St. Louis Park, Minn.



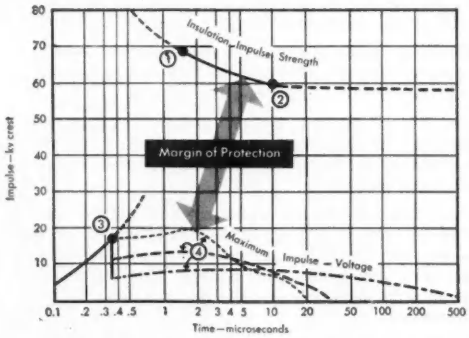
Shielded-Arc Welder Attachment

Used with gas-shielded arc welders, the Fillerweld allows operator to control the continuous flow of filler-metal automatically by means of a finger switch mounted on the torch.

Equipment can be used with GE type WP Inert-Arc welding transformer for welding aluminum, mag-



THE G-E PELLET ARRESTER is also unequalled in durability—the *only* distribution arrester with series gaps sealed in dry, inert nitrogen. Gap electrodes stay bright as new. The Pellets, themselves, are unaffected by service moisture.



THIS GRAPH was made from actual volt-time and ampere-time oscillograms, and from AIEE standard test data. The demonstrated impulse strength of 2400-volt distribution transformer insulation is represented by the curve passing through: (1) the minimum impulse strength on an AIEE standard chopped wave test, and (2) the minimum impulse strength on an AIEE standard full wave test. The impulse voltage allowed by a 3-kv General Electric Pellet Arrester is determined by (3) the impulse sparkover voltage of the arrester on the AIEE standard test wave, and (4) the IR drop across the arrester to ground with (top line) a 65,000 ampere discharge—(middle line) a 20,000 ampere discharge—and (bottom line) a 1500 ampere long duration discharge. The arrows show the unequalled margin of safety.

No other distribution arrester protects so well

HERE'S THE EVIDENCE. The graph below, from actual volt-time and ampere-time oscillograms, shows the unequalled margin of safety that a 3-kv General Electric Pellet Arrester gives a 2400-volt distribution transformer. Higher rated arresters, protecting higher-voltage transformers, similarly show this unequalled margin of protection.

HERE'S THE REASON. This extra protection results from a combination of low sparkover voltage *and* exceptionally low IR drop. Whether lightning currents are high or low, with durations long or short, *no other distribution arrester holds voltages to such low levels.*

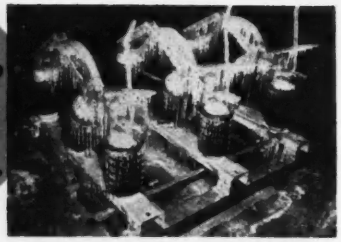
HERE'S YOUR CUE. The Pellet is a valve-type arrester for universal use on urban, rural, or industrial systems. It is available in ratings of 1 kv to 15 kv inclusive. This arrester has been *the* quality-standard for over 25 years—it's your cue for maximum protection. For further information contact your G-E representative or your authorized G-E agent.

Apparatus Department,
General Electric Company,
Schenectady 5, N. Y.

GENERAL ELECTRIC

405-36

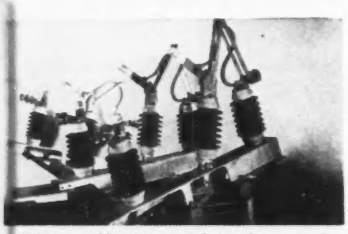
ICE PROBLEMS? Read This...



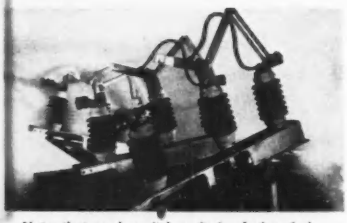
This Chance three phase type WN Switch, with standard controls, was coated in the closed position with over ¾" of hard, clear (bubble-free), ice made with distilled water slowly sprinkled on the switch at various angles to simulate the most severe conditions.

No other switch offers so many operating advantages

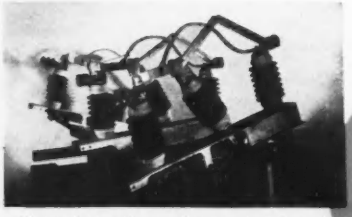
CHANCE WN-VN



"Torture rack" tests proved that performance of the Chance Type WN Switch is not affected by any conceivable warpage of cross-arms. Note side of base is cut away to show control operation.



Note that each switch unit is closing independently of the others. Standard controls were used and no extra leverage was applied. Switch operated easily in spite of the most extreme distortion.



The exclusive Chance Compensator Control mechanism brings all three blades of the switch into completely closed position. No switch or control adjustments were required to compensate for this extreme distortion.

You get top performance under all conditions plus many time, money, and labor saving features when you buy the new Chance WN or VN Gang Operated Switches.

You save on installation because the flanged bases are easy to mount on cross-arms and the interphase shaft can be laid in position after the switch units are mounted—no threading of the shaft is required.

You get dependable operation under all conditions of climate or stress. The exclusive Compensator Control mechanism is housed under the switch base, protected from the weather. This control operates each switch unit independently so that each blade in a three pole switch makes complete contact regardless of warping, twisting, settling or bowing of the wood supporting structure.

A new "crow-bar action" blade, plus the *extra leverage* of the weather protected Compensator Control, makes Chance WN or VN Switches your best buy for performance under heavy ice.

Maintenance time is negligible with WN or VN Switches because all bearings are lifetime lubricated, the flanged bases don't cut into the wood supports and loosen the bolts, and the switch performs properly regardless of structural warpage.

The Compensator Control prevents shock to the insulators and damage to the switch blade in closing, because the closing action is reversed when the control goes through toggle on each individual switch unit. *Slamming the switch closed will not break insulators.* Heavy castings and extra rugged construction also mean long service life without maintenance.

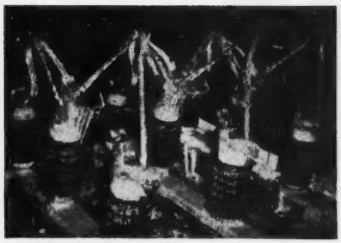
For reliable switching under all conditions, plus time saving installation advantages, specify Chance Type WN or VN Switches. Write for complete information and prices.

Current ratings 200, 400, 600 amps.,
Voltage ratings 7.5, 15, 23, 34.5 and 46 kv.

Warped Cross-arms don't affect WN or VN

You know

Various tests were made at temperatures from 20° F. above zero to 16° F. below zero. After 12 hours of sprinkling, hard blows with a hammer only chipped the ice, leaving a white mark. Yet, one man at the controls opened the 3 phase switch without difficulty.

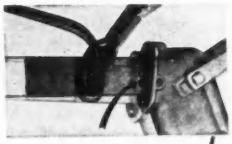


The switch was cleaned and iced again in the fully open position, under the same conditions, with over ¾" of ice on all moving parts of the switch and controls. Operator (background) has started the closing movement.

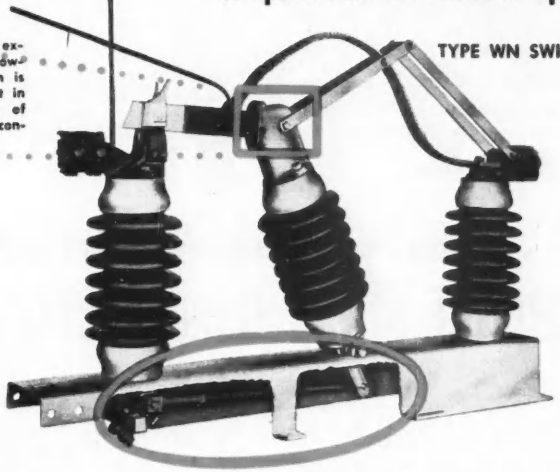
With standard controls one man closed the three phase switch completely with four chopping blows of the blade. There was no damage to the switch in either of these tests and performance was completely satisfactory.

SWITCHES

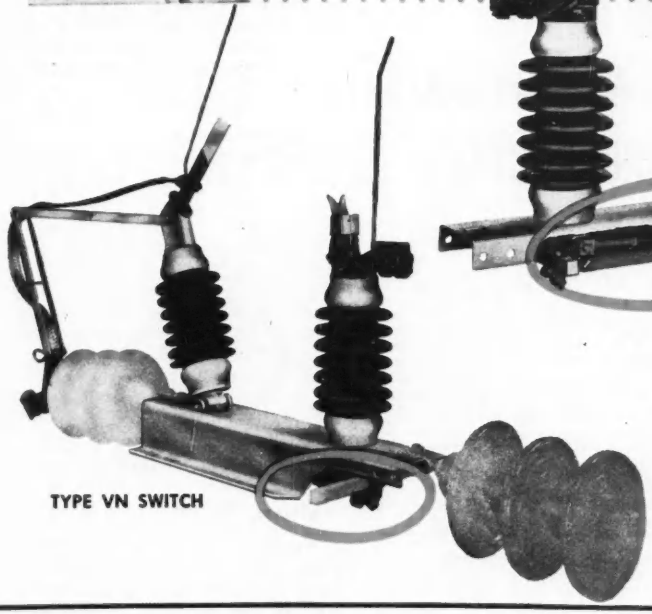
- New Ease of Installation
- Crow-bar Leverage for Ice
- Compensation for Wood Warpage



Double exposure shows exclusive ice breaking "crow-bar action." Pivot pin is forced up against slot in blade — prying rear of blade up ⅜" before contact end is lifted.



TYPE WN SWITCH



TYPE VN SWITCH

COMPENSATOR CONTROL MECHANISM

Cutaway sections of the flanged mounting base show the weather protected Compensator Control that eliminates closing shock and gives extra leverage for smooth, easy operation. This mechanism operates each switch unit independently of the others to give positive, uniform blade contact on all phases. Effect of distortion on the control shaft is negligible, as each blade in a three pole switch arrangement makes complete contact without affecting either of the other two blades.

it's RIGHT when you specify CHANCE

A. B. CHANCE COMPANY ABC Hubbell **CENTRALIA, MO., SAN FRANCISCO, CALIF.**

C50-22

BETTER . . .

. . . any way you look at it!

CHANCE STEEL 8-Way Cone Anchor . . .

Linemen or *Groundmen* like the Chance Steel Cone because it is light weight—easy to handle and the nut retainer makes it easy to install. *Foremen* and *Construction Superintendents* like it because rough treatment and heavy tamping won't break it. They save on installation time and get a good solid job. . . Lighter weight, plus the fact that it stacks well makes the Steel Cone a favorite with *Storekeepers*. *Engineers* specify it because they can depend on steel and because the 8 flat wedging surfaces and the flaring base mean greater holding power. *Purchasing Agents* prefer it because they get all these advantages for less money—solid reasons for economy-minded *Management* men who demand lasting performance. . . Yes, *any way you look at it*, the Chance 8-Way Steel Cone is the best Cone Anchor buy on the market.

ABC INDUSTRIES

You know it's RIGHT when you specify CHANCE

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

nesium or beryllium copper; or with GE type WD-4150 or WD-4200 for stainless steel, copper, inconel, steel and other alloys.

General Electric Co, Schenectady

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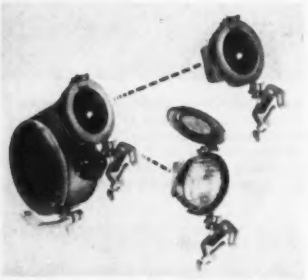


Vehicle Utility Light

The Twin Lenz dual-purpose light consists of a permanent tail light and a combination tail and utility light which can be mounted at any point within 35 feet of the units take-up reel.

For emergency use the swing-over red lens can be removed from the reel, or portable light, to provide a flood light with a 4½ inch sealed beam.

The extended red light has been designed to furnish tail light for all towed equipment and safety and utility (flood) light for field and on-the-highway needs.

Harlan Manufacturing Co, Harlan, Iowa.

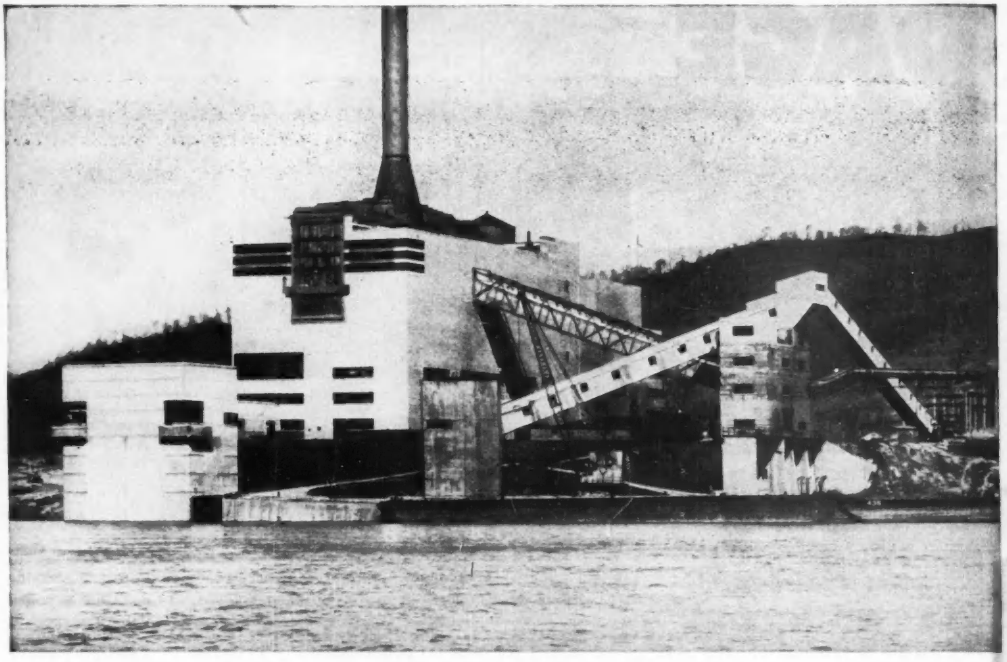
•

Voltage Tester

The Wigginton Voltage Tester has been redesigned to make it safer, more functional and easier to carry and use.

Voltage range covers 110-220-440-500 volts ac and 125-250-600 volts dc. Testers for low voltage and 400 cycle systems are available.

Square D Co, 6060 Rivard St, Detroit 11, Mich.



Unique Circulating Water System Installed in This Power Plant

The R. E. Burger steam-electric plant of Ohio Edison Company is located on the Ohio River well above flood stage—which may reach as much as 60 feet above extreme low water. Water is supplied to the condensers by a patented circulating water system pioneered jointly by Worthington and the consulting engineer, Mr. George W. Saathoff.

All major equipment except circulating pumps, which are designed to operate completely submerged if necessary, are located above flood stage.

The new installation of a Worthington 70,000 sq ft two-pass condenser and auxiliaries, serving a 90,000 kw turbine-generator, is the third Worthington unit in this station. Two 46,000 sq ft condensers were previously installed.

For advice on any new installation or information on a wide range of power plant equipment, consult Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, New Jersey.

HOW IT WORKS

Two full-capacity circulating pumps are used in series.* The primary pump, submerged below extreme low water, is a Worthington motor-driven HIFLO. Its high starting head characteristic is able to deliver enough water for starting purposes. A booster pump—a single-suction volute Worthington MIXFLO, mounted directly upon an hydraulic turbine—starts when there is enough water in the control well. The two pumps then operate automatically in series at full capacity.

Advantage is taken of maximum siphon effect from the condenser drop leg which enters the sealing or control well. From this well, all circulating water is passed through the hydraulic turbine. Thus the static head from sealing well to river level is utilized—75-80% being recovered—in reducing the work of the primary pump, with saving in overall pumping power.

The booster pump functions until rising water renders the turbine ineffective. Then the primary HIFLO works alone, producing full capacity under reduced head.

*In the new unit, there are two half-capacity primary pumps, permitting operation of only one in the winter when low water temperatures prevail.

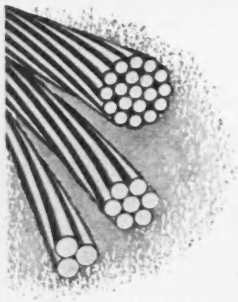
Z.1.1

WORTHINGTON

WORLD'S BROADEST LINE OF STEAM POWER PLANT AUXILIARIES

Feed Water Heaters	Boiler Feed Pumps	Steam Turbines
Steam-Jet Ejectors	Water Treating Equipment	Surface Condensers

PAGE



Stainless Steel
STRAND
AND
Stainless-Copper
CONDUCTORS

Here's WHY they Save

Compared with other types strand of equal breaking strength, they . . .

- have 30-40% greater overload capacity within elastic limit.
- resist corrosion all the way through—not merely through a thin case of soft metal.
- offer highest tensile and vibration-fatigue strength (tensile strength 235,000 psi; corrosion-fatigue limit 50% of ultimate).

Here's HOW they Save

- They permit longer spans—therefore require fewer poles per mile.
- Being lighter, they are easier and faster to install in the field.
- More resistant to destructive factors, they last many times as long before replacement.

Let us tell you the whole story—

specific data, prices, recommended sizes.

PAGE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

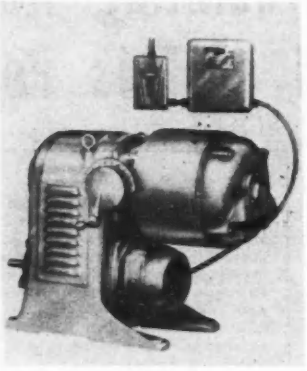
Fixture Servicer

Cleaning and servicing of fluorescent lighting fixtures is simplified by this unit. Counterbalancing of a fixture's weight at all levels is provided by two negator B motors (insert).

A flat spring, formed so its relaxed shape is a tight coil, is wound from a storage bushing to a bushing carrying the cable drum as the fixture is pulled down. Constant counterbalance is produced.

Power is automatically disconnected from each fixture as it is lowered.

Thompson Electric Co, Cleveland



Motor Brake

Controlled braking of U. S. Varidrive Motors is now possible through the use of a new Wagner Type ICB brake.

Reportedly ideal for inching or jogging the ICB offers instant shockless operation without noise and produces a constantly increasing torque during stopping.

Frictional force is controlled directly through magnetic action of the brake. Braking torque once set, is permanent. Adjustment is easily made.

Brake is dc actuated. Power conversion units are used where ac is supplied.

U. S. Electrical Motors Inc, 200 East Slauson Ave, Los Angeles 54, Cal.

•

Duplicator

Original letters, forms, memos, sketches, charts, etc. may be duplicated with a new dry-process trademarked Thermo-Fax. In operation the black type on the original converts infra-red rays into heat which acts on the Thermo-Fax sheet to reproduce the original. The entire operation requires 15 seconds.

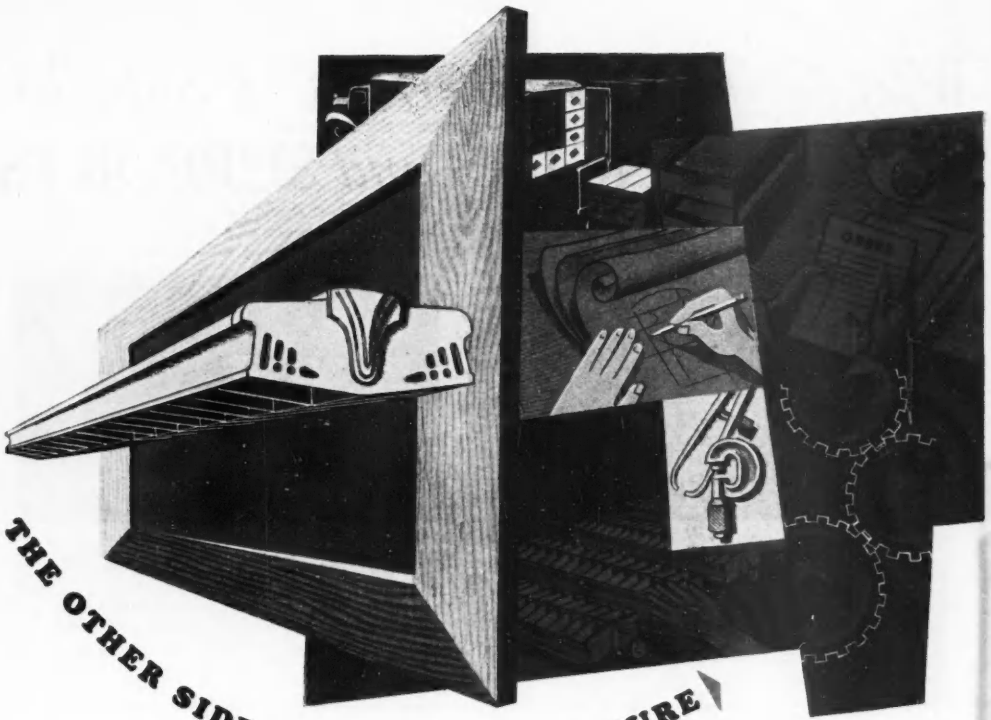
Magna-Crest Corp, 730 Fifth Ave, New York 19, N. Y.

•

Revolving Derrick

A self-contained, full revolving steel derrick—available with either gasoline or electric power has been announced.

Boom lengths of 20, 30, or 40 ft



THE OTHER SIDE OF THE GUTH PICTURE

we are big—
—and we are small

we are big enough to massproduce
any huge installation project—
—and small enough to tailormake that one fixture in
the corner store or the board chairman's glamour office

we are big enough for assembly-line work—
—and small enough to work with you on
any special lighting problem

we are big enough to produce a complete line
of commercial and industrial fixtures—
—and small enough to keep our executives' doors open for
you any time you need help

we are big enough—
—and small enough
to be your friends

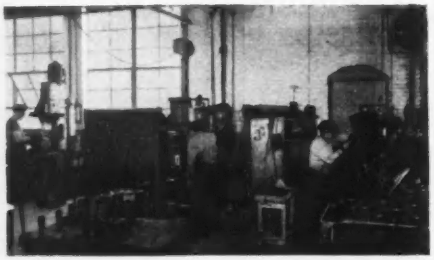
E. P. Guth

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

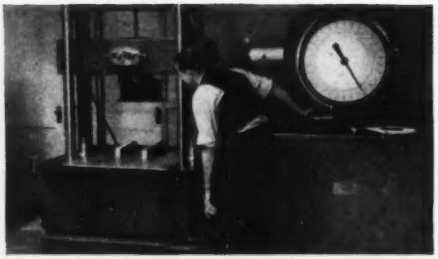
Leaders in Lighting since 1902

Why Grinnell is America's #1 Supplier of PIPE HANGERS *and* SUPPORTS



GRINNELL, ALONE, MANUFACTURES A FULL AND COMPLETE LINE OF HANGERS AND SUPPORTS

No other company, anywhere, makes a line as complete or varied. Grinnell produces hangers in thousands of combinations to support any piping.

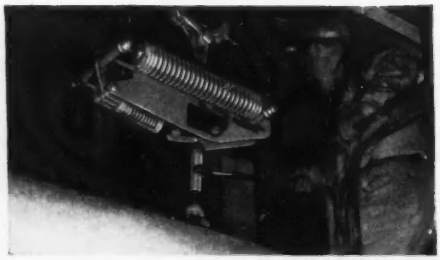


GRINNELL, ALONE, MAINTAINS AN EXPERIENCED LABORATORY STAFF OF TRAINED TECHNICIANS

In its modern, well-equipped laboratory, tests are constantly being made to discover better ways of solving old and new pipe suspension problems.

GRINNELL PROVIDES HIGHLY SKILLED ASSISTANCE AND ADVICE RIGHT FROM THE DESIGN STAGE

Grinnell's Pipe Suspension Department makes available specialized knowledge in the computation of hanger loads and the selection of the correct supports. No other company can match this service.



GRINNELL, ALONE, OFFERS EXPERIENCED FIELD ENGINEERING SERVICE ON THOSE "TOUGH" JOBS

Grinnell maintains an experienced staff of engineers in the field . . . ready to assist you "on the job" with any problems in the erection of pipe hangers and supports, no matter how difficult or complex.

WRITE FOR THIS FREE PIPE HANGER MANUAL

Here, between the covers of a single book, is everything you need to write hanger specifications. This book can be used both as a Grinnell Pipe Hanger Catalog and a comprehensive manual. It's available to you without cost . . . yours for the asking.

Pipe suspension presents a tremendously wide range of problems involving weight, stress, thermal movement, materials and specialized engineering. No one "goes into" the pipe hanger business overnight. Large manufacturing facilities, skilled technicians, and a lot of down-to-earth practical experience are needed.

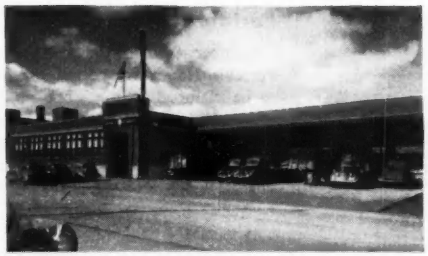
Grinnell has become America's No. 1 supplier of pipe hangers and supports only because Grinnell has specialized in piping for one hundred years. Grinnell has developed a line of pipe hangers and supports for every piping requirement, from the simplest to the most complex. Grinnell, and Grinnell alone, can offer these advantages:—

- Complete "start-to-finish" production facilities — including research, design, manufacture, engineering and field service.
- Practical experience in every type of piping gained during the past 100 years.
- Coast to coast distribution — enabling "out of stock" purchases, anywhere.

It is important to remember that should some detail of piping arrangement make it necessary to deviate from hangers of standard design, Grinnell will design and manufacture hangers to meet the special requirements. Also, Grinnell is always ready to co-operate with engineers and architects in the preparation of pipe suspension specifications.

Call Grinnell for pipe hangers and supports.

Grinnell makes pipe hangers and supports for every installation . . . from a simple water pipe to high pressure, high temperature steam lines. All are scientifically designed, ruggedly built.



GRINNELL, ALONE, THROUGH ITS CONVENIENT WAREHOUSES CAN SUPPLY YOU "OUT OF STOCK"

No manufacturer of pipe hangers offers a distribution system as thorough or efficient. Grinnell warehouses are located in 30 principal cities . . . with jobbers in practically every city, coast to coast.

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company Inc., Providence, Rhode Island

Sales Offices and Warehouses in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems

● "Glad it's a Koppers Pole"—this man's sentiments are echoed throughout the utilities world.

For Koppers Poles, to utility companies, represent savings in maintenance costs. Savings in pole replacements. Increased revenue that comes with long periods of *continuous* company service.

Specify Koppers Full-Length Pressure-Creosoted Poles. You'll find these strength-retaining poles have a decided effect on your line operation, making it easier and more economical.

KOPPERS COMPANY, INC. **PITTSBURGH 19, PA.**

KOPPERS **PRESSURE-TREATED WOOD**

with load capacities from 2,000 lbs at 40 ft radius to 10,000 lbs at 10 ft radius are available.

Rotating structure which supports the boom and boom supporting members also supports the hoisting machinery.

Clyde Iron Works Inc, Duluth, Minn.

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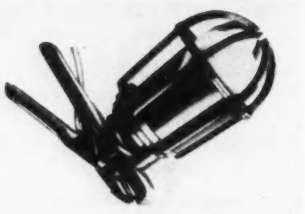


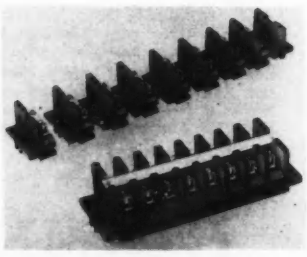
Portable Handlamps

Gripper jaws of the SR3 Hivolt Portable Handlamp permit the lamp to be clamped at the work position to any surface edge up to 1½" thick.

Unit takes up to 100 watt lamp in most models.

PM Sales Co, 443 Broad St, Newark 2, N. J.

•



Terminal Blocks

New Add-A-Point terminal solderless connectors will accommodate wire sizes from No. 14 to 16.

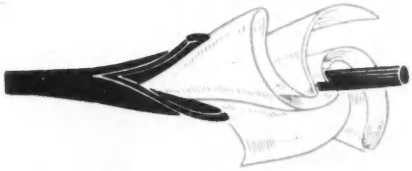
Blocks are rated to 60 amperes and reportedly operate safely to 750 volts.

Wama Co, Baltimore 2, Md.

forget about **this** ↓

DURALINE* provides added assurance against power outages caused by moisture, whether in the form of rain or sleet or snow. Duraline won't festoon, is more resistant to damage by foreign objects.

install Duraline ...



DURALINE beats the weather in any season. Its exclusive, continuous interlocked fibrous sheath is thoroughly impregnated with genuine URC saturants and covered with URC finishers. 81346

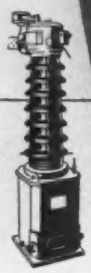
For the full technical story on Duraline with copper, Copperweld or aluminum conductor, just contact your nearest Anaconda Sales Office. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U.S. Pat. Off.

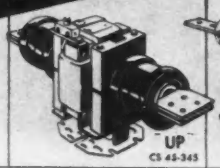
the right cable for the job

ANACONDA® **WIRE AND CABLE**

The most complete line of Instrument Transformers in the industry



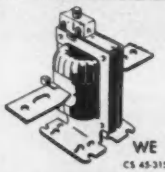
OCT
CS 45-445



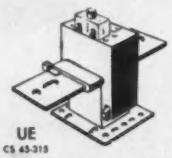
UP
CS 45-345

CT
CS 45 339
CS 45-340

A
CS 45-305



WE
CS 45-315



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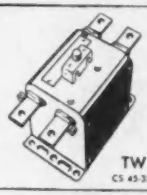
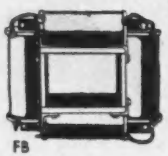
CS 45-315



TW
CS 45-320



FB
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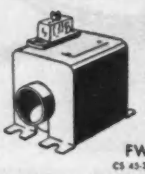
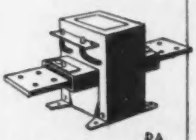
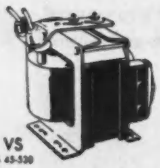


FW
CS 45-325

TYPE MP-15
3-phase, 3-wire
CS 45-720

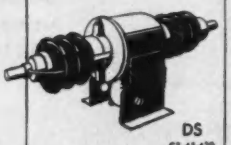


PA
CS 45-330



VS
CS 45-530

OC-133
CS 45-310



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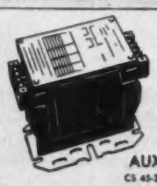
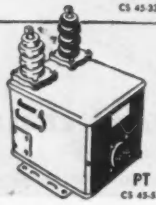


AUX.
CS 45-390



PT
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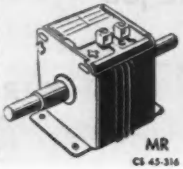
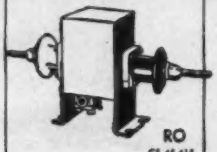


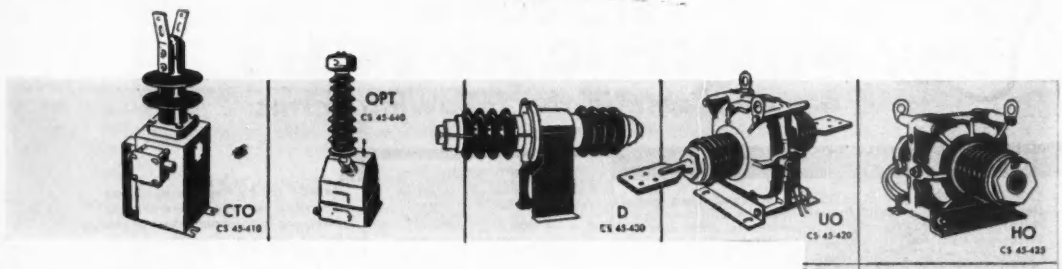
MR
CS 45-316

TA
CS 45-530



RO
CS 45-413

OTW
CS 45-487



Versatile . . . for metering, relaying, control!

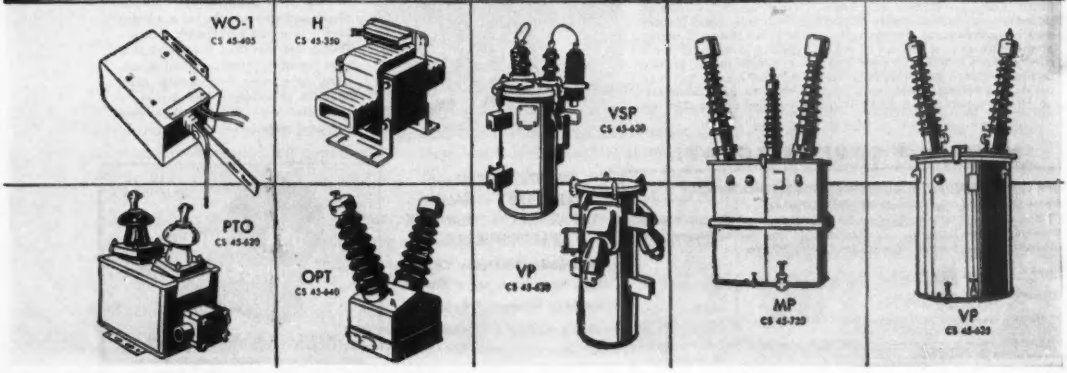
The Type MP combines current and potential transformers in one unit for single or three-phase systems, from 2.5 to 161 kv. Westinghouse Outdoor Metering Outfits, Type MP, are designed for highest accuracy metering, relaying and control device applications.

Because he handles the most complete line in the industry, your Westinghouse salesman has specific answers to all your instrument transformer problems. For further information on any of these transformers, ask him for a copy of the catalog section identified by the "CS" number under each transformer illustrated. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70605

YOU CAN BE SURE... IF IT'S

Westinghouse

INSTRUMENT TRANSFORMERS



DOW CORNING SILICONES

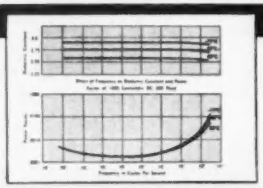
Heat-Stable, Moisture-Proof

SILICONE DIELECTRIC MATERIALS

are available in the following forms:

LIQUID DIELECTRICS

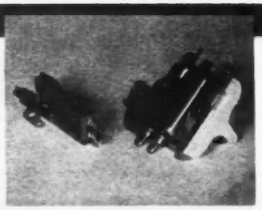
DOW CORNING 200 FLUIDS are a series of clear, inert liquids, notable for their thermal stability and for their remarkably flat viscosity-temperature slopes. Available in viscosities from 0.65 to 1,000,000 centistokes. Pour points range from −123° to −47°F. and flash points range from 30° to 600°F. Low dissipation factors at elevated temperatures or at high frequencies, inertness to moisture, oxidation resistance and heat stability make Dow Corning 200 Fluids unique among liquid dielectrics.



As indicated by these curves, neither frequency nor temperature changes have any pronounced effect on the power factors or dielectric constants of Dow Corning 200 Fluids. Power factor and dielectric constant of 1000 cs. fluid at −17°, 23°, and 83° C. are plotted against frequencies ranging from 10 to 10^{10} cycles per second.

DIELECTRIC COMPOUND

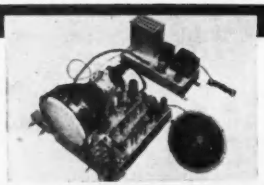
DOW CORNING 4 COMPOUND is a nonmelting water-repellent dielectric paste which retains its grease-like consistency at temperatures from −70° to 400°F. It is highly resistant to oxidation and to deterioration caused by corona discharge. Power factor is less than 0.003 at frequencies up to 10,000 megacycles; volume resistivity is more than 10^{12} ohm centimeters at temperatures up to 400°F.; dielectric strength is more than 500 volts per mil at a 10 mil gap. Dow Corning 4 meets all requirements of Specification AN-C-128a.



Dow Corning 4 packed in phonograph pick-up head cartridges increased crystal service life 20 times. The silicone compound prevents Rochelle Crystals from deteriorating due to absorbed moisture. It also acts as a viscous damping medium, thereby reducing excess vibration and enabling the head to handle a much higher frequency.

ELECTRICAL INSULATING VARNISHES

DOW CORNING 996 VARNISH dries tack-free in not more than 3 hours at 150°C. Dielectric strength measured with 2 inch electrodes on 2 mil films baked for 16 hours at 150°C. is 1000-2000 volts/mil, dry, and 500-1500 volts/mil, wet. Heat flexibility is more than 100 hours at 250°C. Cured films have good resistance to dilute acids, concentrated hydrochloric acid, and dilute or concentrated alkalies.

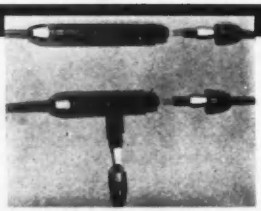


Flashover in high voltage television power supply coils can set ordinary organic varnish aflame. To eliminate this fire hazard, coils are impregnated with Dow Corning 996. Highly resistant to arcing, 996 provides positive protection against carbon tracking for the life of the entire set.

SILASTIC *, THE DOW CORNING SILICONE RUBBER

Silastic combines the remarkable heat stability and moisture resistance of resinous silicones with the physical properties of rubber, including resilience, shock and abrasion resistance, and resistance to both mechanical and electrical fatigue. Its dielectric properties show little change over a wide range of frequencies, even after aging at high temperatures. The surface resistivity of Silastic is high, and its thermal conductivity is about twice as great as that of either organic rubber or resinous insulating materials.

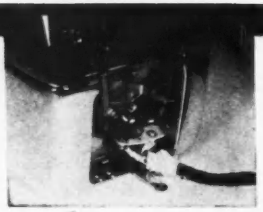
*T.M. REG. U.S. PAT. OFF.



Completely eliminating taped connections on aircraft antennae, white Silastic seals reduce static and corona discharge by as much as 90%. They retain their resilience as well as their dielectric properties, excluding moisture and foreign matter after long exposure to the full range of ground and stratospheric temperatures.

SILICONE-GLASS LAMINATES

DOW CORNING THERMOSETTING RESINS are used to bond inorganic fabrics and finely divided particles such as powdered metals or mica. Typical ⅛" silicone-glass laminates have a flexural strength of 22,000 to 45,000 psi; water absorption after 24 hours of 0.25 %; dielectric strength with continuous filament cloth of 250 volts/mil or more; power factor of 0.002 at 1 mc; loss factor of 0.007 at 1 mc; wet insulation resistance of more than 10^{12} ohms; arc resistance of 300 seconds and a heat distortion value above 250°C.



For maximum dependability and long service life, silicone-glass terminal blocks and contactor bases are being used in late model automatic toasters. Tests prove that Dow Corning silicone resin bonded glass laminates are more rigid, more heat-stable, more resistant to moisture and easier to fabricate and assemble than conventional materials.

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WHAT THEY'RE SAYING
at industry meetings

Northwest Power Situation

J. Frank Ward, *president, American Public Power Association before House Public Works Committee.*

HR 4963 contains provisions which would place the control of rates for power produced from steam plants authorized by this bill under the sole control of the Department of the Interior without review by the Federal Power Commission.

This arrangement is contrary to our country's long established policy of checks and balances in government operations. Without checks, the way is open to establish rates that will serve purposes not necessarily beneficial to ultimate consumers.

Both private and public utilities of the Northwest recommend further development of federal and non-federal hydro plants, in preference to fuel-fired electric generating plants. This is primarily due to a fuel supply problem—lack of coal in Washington, and the problems of oil transportation, storage, and defense needs of oil. There is only one coal field in Washington with an output sufficient to run one 100,000 kw steam plant.

The bill which devotes power so produced to objectives of the Defense Production Act of 1950 would only increase power demands in this area.

Steam Station for the Northwest

Oscar L. Chapman, *Secretary of Interior, before House Committee on Public Works.*

I am urging enactment of House Bill 4963. The Northwest has witnessed the greatest expansion in hydro development in the country during the past 15 years. However, demand for power is increasing faster than generating capacity can be added. The increased demand is due to increased domestic needs, expanded commercial and industrial uses but not due to new aluminum plants.

Fuel-fired electric generating plants represent the immediate solution to this power shortage, and would not in any way detract from the need for continuing construction of hydro plants.

While fuel generated power is more costly than hydro, it could be used to supplement hydro during low water periods. The Federal Power Program in the Northwest has been of great value to this area, and fuel-fired plants authorized by HR 4963 are essential to maintain these existing facilities.

Power Needed in Northwest

Robert M. Hatfield, *vice chairman of Munitions Board, before House Committee on Public Works.*

The Northwest power shortage has already resulted in a production loss of about 36 million lb of aluminum per month and will shortly result in a shortage of 1.5 million lb of magnesium per month.

The Defense Department has consistently recommended additional power generation for several years. Defense has felt the Cowlitz River Project and Pelton Dam Project should have received immediate consideration. We have also sponsored approval of a 200-kv transmission tie-line between Oregon and Northern California which would make 100,000 kw available to the Northwest during low water periods.

Fuel powered steam plants might be a solution to the power shortage, but the availability of oil presents quite a serious problem. At the present time, 10,000 barrels of crude oil are imported from Borneo to meet the Pacific Coasts' oil needs.

Federal Steam Plants

Frank M. Wilkes, *president, Southwestern Gas & Electric Co. before House Committee on Public Works.*

The Interior Department proposes to establish a precedent for federally financed and owned steam electric stations, that will be extended to other parts of the country, especially the Southwest. Congress has consistently denied any Federal agency this privilege, but Interior is striving to slip by this clear will of Congress.

Interior can easily establish a power shortage by installing aluminum plants anywhere. The only logical place for these plants is the Southwest where unlimited supplies of natural gas are available. When constructed, an accompanying internal-combustion generating station should be built to supply the plant's needs.

No one is opposing the Defense effort, yet every effort should be made to prevent nationalization of the utility industry in the United States.

The ONLY Soldering Tool You Need for light or HEAVY Work!

Switch *instantly* from light to heavy work—or vice versa—with the 250-watt Weller Soldering Gun. *Controlled* dual heat makes the Weller Gun the only soldering tool you need for *all types* of work. 5-second heating saves time and current on every job, too. Your Weller Gun pays for itself in a few months!

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NEWS ABOUT PEOPLE

Allis-Chalmers Appoints Casper Power Dept Head

R. M. Casper has been named manager of Allis-Chalmers Manufacturing Co's new power department. The electrical and mechanical power departments were combined to form the new department.

Other appointments in the power department include F. W. Bush, assistant manager in charge of the electrical sections; C. C. Jordan, assistant manager in charge of the mechanical sections; R. N. Miers, manager of the steam turbine section; C. R. Braun, assistant to Casper; and E. J. Schiebenes, office manager.

R. M. CASPER

Casper has been manager of Allis-Chalmers electrical department since 1949. He joined the company in 1936 as a sales representative in the Detroit office. Six years later he was named sales engineer in charge of motor and generator sales in the electrical department, and in 1947 became manager of the motor and generator section.

With Allis-Chalmers since 1928, Bush has been assistant manager of the electrical department since 1946. Previously he was assistant to the manager of the department and before that sales engineer in charge of transformer sales.

Jordan started with the company in 1923. He was named manager of the central station and industrial sales department in 1948 and more recently has been manager of the steam turbine section.

Miers has been associated with the company's steam turbine department since 1928. He served successively as resident turbine specialist for East Coast offices and manager of the mechanical drive and industrial turbine section before being named manager of the sales section of the department in 1948.

Braun came to Allis-Chalmers in 1940 and was supervisor of the marine sales division in the steam turbine department before being named assistant to the manager of the mechanical power department. Joining the company 40 years ago, Schiebenes has served in various capacities and has been office manager of the steam turbine department for many years.

As part of the organizational change, the centrifugal pump department becomes a section of the power department under the management of H. P. Binder.

•

Dr William A. Edson, professor of electrical engineering at Georgia Institute of Technology, has been named director of the school of electrical engineering. He replaces **Dean D. P. Savant** who retired in July. Before joining Georgia Institute, Edson served on the staff of Bell Telephone Laboratories and as assistant professor of electrical engineering at Illinois Institute of Technology.

R. R. Katterhenry and **W. A. Gentry** have been appointed assistant vice presidents of Indianapolis Power & Light Co. Katterhenry, executive assistant of the utility since 1944, will supervise purchasing, labor relations, and property protection. He has been with Indianapolis P&L for 35 years and has served as purchasing agent for 21 years. Gentry will have charge of the operating departments and the mechanical and construction department. He joined Indianapolis in 1945 and previously was operating superintendent of Memphis (Tenn.) electric system for 17 years.

Westinghouse Names Brown Lamp Sales Head

Westinghouse Electric Corp has appointed Don M. Brown manager of sales administration for its Lamp Division. He has been assistant manager since last May.

The company also named John W. Schaffer to the staff of the East Pittsburgh Divisions' general manager. He will be succeeded as industrial relations manager at East Pittsburgh by Clark C. Frame. In another appointment Thomas E. Stapleton was made Eastern District finance representative.

Brown joined Westinghouse in 1930, starting in the New York City lamp order service department. He transferred to the executive sales staff a few years later and in 1947 became manager of production planning.

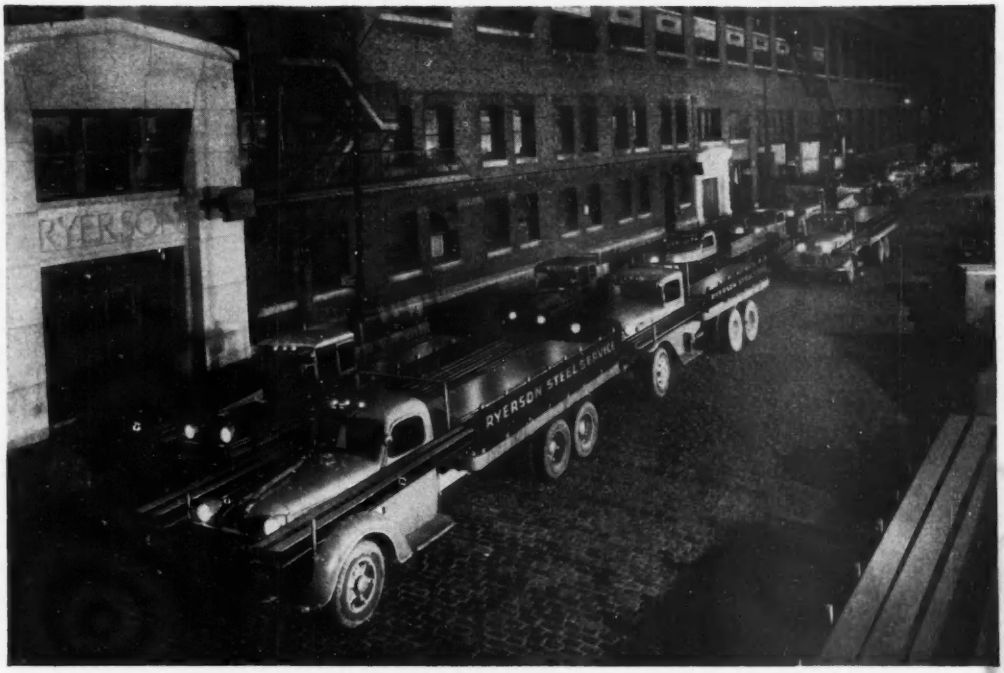
With Westinghouse since 1910, Schaffer began as a machinist apprentice and worked his way up through the supervisory ranks. He became industrial relations manager at East Pittsburgh in 1944 and holds the Westinghouse "Order of Merit"—highest honor awarded by the company to its employees. Frame has been a member of the headquarters plant labor relations staff for the past seven years. He enrolled in the Westinghouse Graduate Student Training Course in 1930 and was engaged in personnel and industrial relations work at East Pittsburgh before being transferred to the labor relations staff in 1944.

Before joining Westinghouse, Stapleton served as assistant credit manager of the Irving Trust Co's Consumer Finance Division in New York.

•

William M. Nave has been named general manager of General Electric Co's electronic tube plant under construction at Anniston, Ala.

Harold A. Cooch, chairman of the board of Canadian Westinghouse Co, Ltd, has been elected president of the Canadian Electrical Manufacturers Association. Starting as a sales engi-



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Here are Ryerson trucks all loaded by the night shift and ready to be on their way to our customers—early in the morning. This "after-hours" operation is typical of the way we work at Ryerson to speed up your steel deliveries.

Every kind of steel is on hand for quick shipment at your nearby Ryerson Plant. Though stocks are currently out of balance due to ever-increasing defense needs and unprecedented civilian demand, we are still able to serve you.

Your Ryerson representative has specific answers to your questions involving the purchase, application or fabrication of steel. He is fully posted, for instance, on the new alloys and on practical substitutes for hard-to-get steels. So, for any kind of steel—for complete steel service—call your nearest Ryerson Plant.

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ALLOYS—Hot rolled, cold finished, heat treated. Also tool steel
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Field superintendent gets trouble call by radio. Directs field crews to outage while he drives there himself.

Radio-directed crews reach trouble in record time. KGE can cover area with fewer trucks, fewer men . . . thanks to RCA 2-way radio

How a Kansas Utility

Speeds Up Field Operations

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Radio directs 107 trucks and cars all over southeastern Kansas for Kansas Gas and Electric Company. Could your business profit from radio, too? Read answer below . . .

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Gives Faster, Better Service

Eight base radio stations blanket the area with main dispatch headquarters at Wichita. Over this network, calls can reach any truck or auto anywhere in the territory. Result: faster service all along the line, less outage time because radio sends the nearest crew to the trouble. Less lost mileage, less wear and tear. More efficient use of men and equipment. And more reliable communications—especially when telephone lines are knocked down by storms. *It's all typical of what RCA 2-way radio can do in any widely spread-out field operation.*

Could Your Business Use 2-Way Radio?

If you operate far-scattered field crews, RCA 2-way radio can save you time and money in dozens of ways. Puts a "phone" in every truck or car. Operates in all weather. Uses standard tubes. Low operational cost. Easy to install and maintain. Mobile units are compact, lightweight, rugged.

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RCA helps put radio to work for you. Makes initial study. Helps with FCC permit, installation. And nation-wide RCA Service Company handles installation and service if desired. Find out *now* how 2-way radio can save time and money for *you*. Clip and mail coupon for your FREE 2-way radio booklet . . . *today*.

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neer in 1910 with Canadian Westinghouse, Cooch has served the company ever since. He became president of the company in 1949 and chairman of the board last year.

Roy T. Duncan, commercial manager of Detroit Edison Co, has retired after 49 years' service with the company's sales department. He started with the company as a sales clerk in 1902. Rising through the ranks, Duncan became commercial superintendent in 1938 and commercial manager ten years later.

George W. Acock has been named product application engineer of Rome (N. Y.) Cable Corp. A member of the company's engineering department, he will make his headquarters in Rome and will cover the southern and eastern areas of the country. Before joining Rome Cable, Acock worked for General Electric Co and John A. Roebling's Sons Co.

•

GE Appoints McCune, Others to New Positions

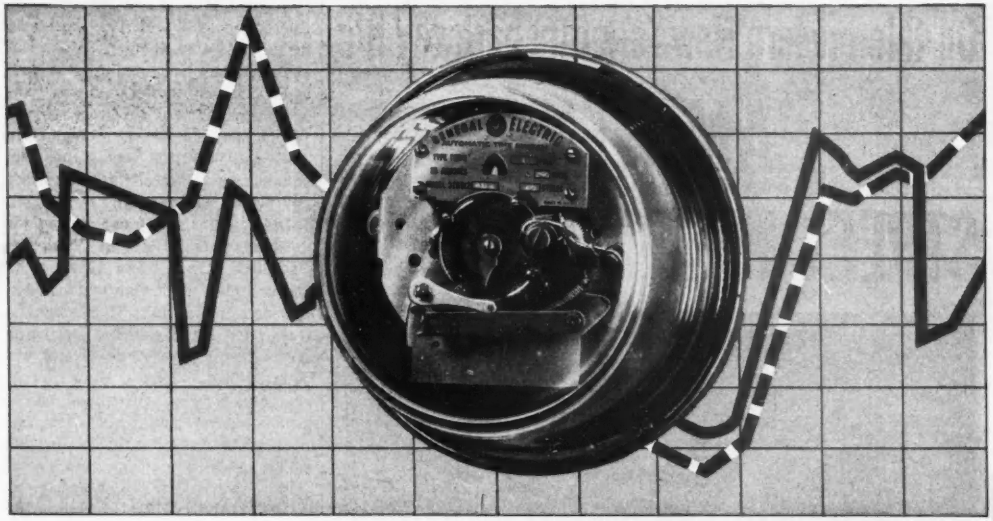
General Electric Co has appointed Francis J. McCune assistant manager of the Engineering Services Division. He formerly was manager of engineering of the Large Apparatus Division.

In other appointments GE named Carl H. Rinne general manager of the Specialty Transformer and Ballast Department at Fort Wayne, Ind., and C. Howard Black general manager and W. K. Mattson assistant to the general manager of the Meter and Instrument Department at Lynn, Mass.

McCune joined GE in 1928 on the Test Course and subsequently held positions in International GE's commercial department and in GE's West Lynn Works, becoming assistant works engineer at West Lynn in 1945.

The following year he went to Schenectady as a member of the apparatus Department design engineering staff. Two years later he was appointed assistant to the general manager. Moving to Richland, Wash., in 1949 McCune became assistant general manager of the Nucleonics Department. He returned to Schenectady in 1951 as manager of engineering of the Large Apparatus Division.

Starting with GE in 1930 Rinne served as a traveling auditor, a member of the president's office staff in New



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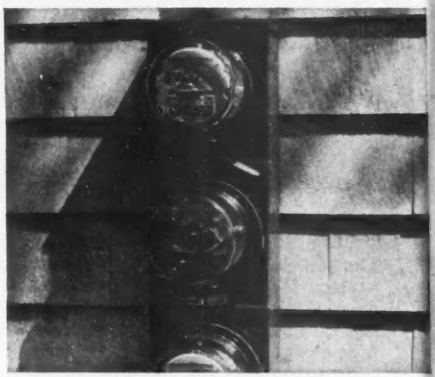
With increasing demand for power today, off-peak control of water heaters is becoming more and more necessary. The new and improved General Electric TGW-2 time switch cuts down your peak demands by providing you with inexpensive, efficient control of water heater loads.

Combining low first cost with low installation cost, the new TGW-2 operates with minimum maintenance. Important design improvements have added to attractive appearance and simplified the time setting operation.

Reliable mechanism is powered by the time-proved Telechron* motor. The Type TGW-2 is available with single or double pole operations and with riders or cut dial for on-off operations.

For approaching seasonal peak loads, make certain your installed capacity is being utilized to best advantage. Contact your local G-E apparatus office for more information on how the TGW-2 can improve your load curve and build big savings. For further details on the time switch, write for Bulletin GEC-705, Section 603-126, General Electric, Schenectady 5, New York.

*Registered Trademark of General Electric Co.



ATTRACTIVE APPEARANCE of TGW-2 is important customer feature—uses same base and cover as I-50 watthour meter.

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Amplex offers you the most complete line of street lighting lamps ever put on the market . . . a type and wattage for every kind of service. Among these, Amplex Weatherproof Bulbs are probably today's fastest-growing specification. Amplex Weatherproof Lamps are formed of "hard glass," ending failures due to climatic conditions . . . providing maximum dependability and savings.

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York, and later became affiliated with International GE. In 1939 he joined the GE's Air Conditioning Department at Bloomfield, N. J., and in 1942 went to Schenectady to work on war projects accounting. Rinne went to Fort Wayne as assistant works accountant in 1947 and later that year became accountant for the Specialty Transformer and Ballast Department.

Black, manager of engineering for the Construction Materials Division at Bridgeport, Conn., since 1948, joined GE in 1924. Following various engineering assignments in Schenectady he transferred to Philadelphia serving as application engineer on switchgear equipment. In 1930 he was put in charge of engineering for metal switchgear equipment and a year later was named managing engineer for air circuit breaker equipment. Black went to the Trenton, N. J., switchgear plant in 1942 where he directed engineering and manufacturing operations. Returning to Philadelphia in 1944 he was made manager of engineering for the Switchgear Department.

Mattson has been accountant at the Meter and Instrument Department since 1948. Henry P. Schott succeeds him in that position. Mattson started with GE in 1919 as a payroll clerk at the Lynn River Works and later served as cashier, paymaster, and works accountant for the West Lynn Works. Schott started to work for General Electric in 1946.

•

D. Ward Pease, research engineer for A. B. Dick Co for 18 years, has been appointed assistant to the chairman of the electrical engineering department of Armour Research Foundation of Illinois Institute of Technology.

H. V. Rasmussen has been appointed executive engineer at the Wellsville, N. Y. plant of Worthington Pump & Machinery Corp. He has served with both Westinghouse Electric Corp and De Laval Steam Turbine Co.

OBITUARY

Dr Anton Frederik Philips, 77, former president of the Philips Bulb & Radio Works, Eindhoven, the Netherlands, died in that city Oct. 7. Philips started to work for the company which was started as a bulb factory by his brother when he was 20

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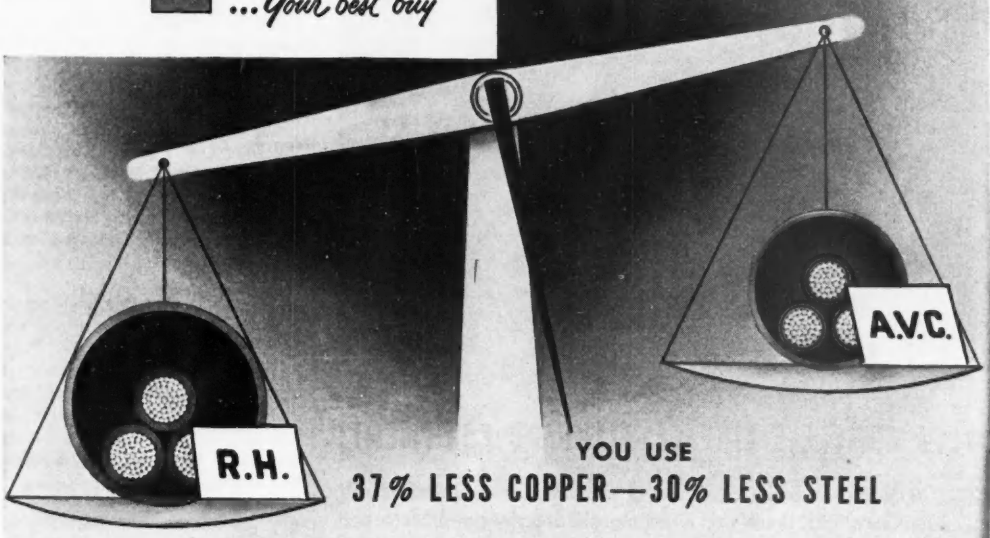

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Specifying Russell & Stoll explosion-proof standard units provides this certainty of satisfactory service, because these ready-to-use "packaged" components possess precision uniformity of performance keyed exactly to the job each must do. They eliminate the uncertainties, delays and expense of special design equipment.

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PRECISION BUILT ELECTRICAL EQUIPMENT SINCE 1902

as a traveling agent. He retired as president last May because of ill health.

Harold J. Bash, 59, assistant secretary of Toledo Edison Co died Sept. 23. He started with the company as a junior engineer in 1916 and a year later joined Railway Light, Heat & Power Co, St. Joseph, Mo., as an engineer. After serving with the Army Corps of Engineers during World War I, he returned to Toledo Ed in 1919. Bash was named assistant treasurer in 1939 and assistant secretary in 1947.

Ira M. Cushing, 76, former member of the Boston Edison Co engineering staff, died Oct. 1 at Wollaston, Mass. Cushing served Boston Edison for 18 years retiring in 1943 and previously worked as an electrical engineer in the Boston office of General Electric Co for 18 years.

George L. Donnett, 61 manager of signal equipment sales for Graybar Electric Co, died Oct. 3 at Pelham, N. Y. He joined the company as a clerk in Cleveland in 1920 and came to New York in 1932 and served as sales engineer in the communications department before becoming signaling sales manager in 1949.

Roy E. Bowen, 66, former chief electrical engineer for the Indiana Electric Corp, died Sept. 25 at Indianapolis, Ind. He joined Indiana Electric, predecessor of Public Service Co of Indiana, as chief engineer in 1925. He left the company in 1935.

Bernard I. Valentine, 38, Idaho Power Co engineer, was killed in an airplane crash Sept. 23. He had been with the company 15 years.

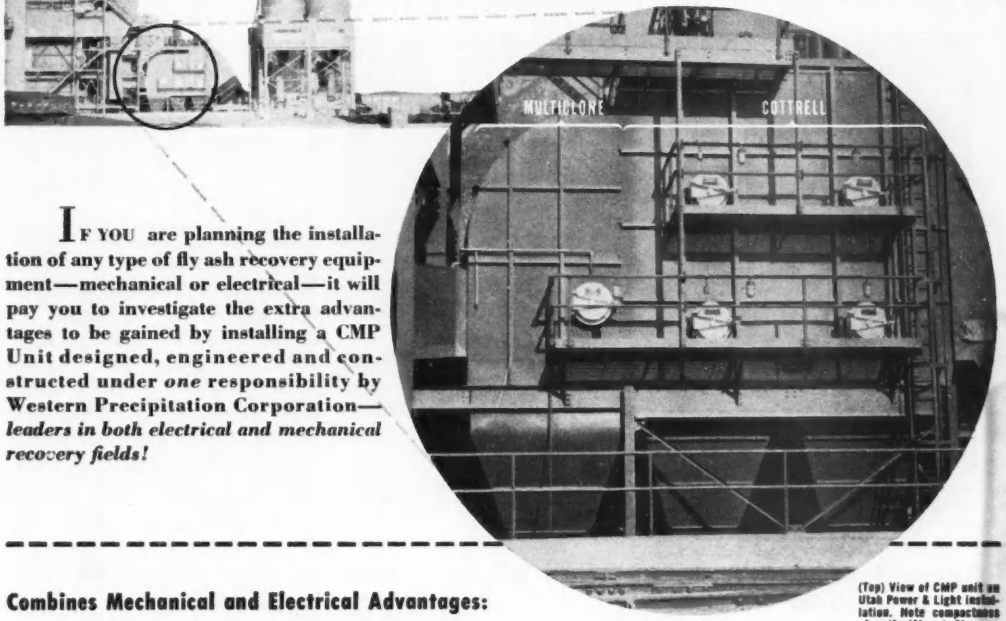
W. H. Whitton, 74, former wholesale sales manager of Consolidated Edison Co of New York, died at Poundridge, N. Y., Oct. 2. He retired in 1937 after more than thirty years with Con Ed.

John Summersett, 65, engineer with Pacific Power & Light Co since 1946, died recently at Portland, Ore. He was engaged in construction of PP&L's Yale project.

Alfred J. Gilg, 49, a member of the service department of Babock & Wilcox Co for 20 years, died Oct. 11 at Elizabeth, N. J.

Planning A Fly Ash Recovery Installation?

Consider these important advantages of a WESTERN PRECIPITATION CMP UNIT!



(Top) View of CMP unit on Utah Power & Light installation. Note compactness of unit. (Above) Close-up of same installation.

IF YOU are planning the installation of any type of fly ash recovery equipment—mechanical or electrical—it will pay you to investigate the extra advantages to be gained by installing a CMP Unit designed, engineered and constructed under *one* responsibility by Western Precipitation Corporation—*leaders in both electrical and mechanical recovery fields!*

Combines Mechanical and Electrical Advantages:

A CMP (Combination Multiclone-Cottrell Precipitator) Unit combines—in one compact installation—both mechanical and electrical recovery principles, so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally cleans the gases of the larger and heavier fly ash particles (down to a few microns in diameter)... and the COTTRELL Precipitator then electrically removes the very small particles remaining in the gases. This combination arrangement has important advantages:

1. Using the MULTICLONE for cleaning out the heavier particles permits the bulk of the recovery operation to be performed with relatively low-cost equipment.

2. Using the COTTRELL for final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired—with a high efficiency, compact Precipitator unit.

3. Each type of unit—MULTICLONE and COTTRELL—can be arranged for its most efficient application. MULTICLONES may be connected to each separate boiler, if desired, and their draft requirement cut out when the boiler is down... while a central COTTRELL handles all gases and operates at higher efficiencies, with continued low power cost, when one or more boilers are down.

4. During soot-blowing periods, or while warming up cold boilers, the MULTICLONE efficiency usually increases, preventing overloads of detrimental carbon from reaching the COTTRELL.

Only Western Precipitation Combines Multiclone and Cottrell "Know-How"—In ONE Organization!

A vital factor in obtaining maximum efficiency and economy in CMP installations is the proper balance of mechanical and electrical recovery equipment to the individual requirements of *each* application. Western Precipitation is unique in that it not only pioneered the commercial application of COTTRELL Electrical Precipitators over 43 years ago, but also has been a leader for many years in the *mechanical* recovery field with its widely-recognized MULTICLONE Collectors.

Result—Western Precipitation has the all-important "know-how" and experience in BOTH fields... knows from first-hand experience how to fit the *right* equipment in the *right* place, to do *your particular* job ... and can provide the complete installation under ONE responsibility and ONE overall guarantee!

Let Our Experienced Engineers study your recovery requirements and make recommendations on the equipment best suited to your operations. A wire, phone call or letter to our nearest office places this unique "Know-How" at your service, without obligation!

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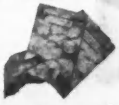

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PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

MANUFACTURERS and MARKETS

SCALE MODEL is used by J. L. Wagoner of Westinghouse Electric Corp to show how large blocks of power can be distributed efficiently to all points of use in a plant with a bus-duct distribution system, protected with arc-quenching breakers. Speaking at opening of traveling industrial exhibit "More Production Ahead," he said greater use of power at machines would raise level of production

Telegraph Center Opened by GE at San Francisco

A million-dollar telegraphic switching center linking 15 key western cities with the country's largest industrial leased wire system has been placed in operation by General Electric Co at San Francisco.

The new facility will permit establishment of 22 new stations at GE installations throughout the West, ten of which will be in cities not previously served by the network.

Communities newly incorporated into the system are San Diego, Fresno, Ontario, Sacramento, San Jose, Calif.; Phoenix, Ariz.; Salt Lake City, Utah; Spokane, Pasco, Richland, Wash.

Of the remaining new stations, six are going into operation at Los Angeles, two each at San Francisco and Oakland, and one each at Seattle and Portland. All five cities had one or more stations on the old network.

The San Francisco center is the eighth switching point in a 60,000-mile GE telegraph system leased from Western Union. A total of 250 stations are on the network in 110 cities.

Feature of the new center is a Western Union push-button system which transmits the average message in less than a minute. Similar devices at other switching points enable the network to handle 200,000 words a day. It is estimated that the new equipment will cut rerouting time on the average message by 50%. Messages are retransmitted without retyping at any point.

•

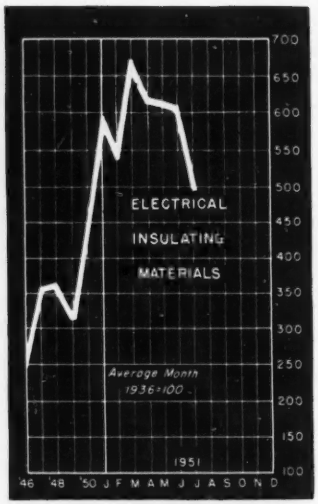
Will Expand Coolerator

International Telephone & Telegraph Corp plans a $1,750,000 program to expand and modernize the facilities of Coolerator Co, Duluth, Minn., which it purchased from Gibson Refrigerator Co last July. The company intends to produce a "new and greatly improved" line of refrigerators, home freezers, and electric ranges in 1952. IT&T also will expand the present distributor and dealer organization and step up national advertising, sales promotion, and merchandising programs. IT&T, a telecommunications firm, has been adding to its manufacturing subsidiaries in recent years. These now include Federal Telephone & Radio Corp and Capehart-Farnsworth Corp.

Insulating Materials Sales Decrease 19% During July

Sales of electric insulating materials decreased sharply in July, falling 19% below those for June.

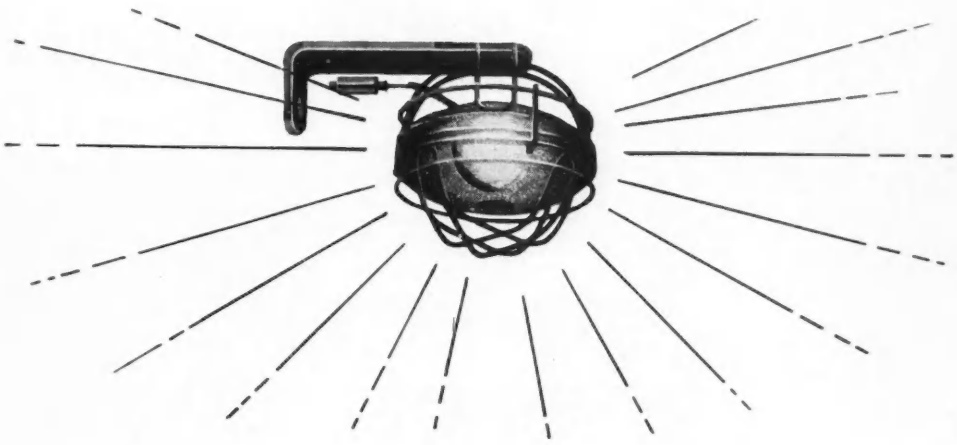
The index for sales billed, compiled by the National Electrical Manufacturers Association, dropped to 494 in July compared with 610 in June. July sales however were 34% higher than those for July, 1950, when the index read 370.



MANUFACTURING BRIEFS

General Electric Co's Danville, Ill., plant has turned out its 25-millionth fluorescent lamp ballast. To mark the occasion, September 28 was proclaimed "Silver Ballast Day" in Danville and day-long ceremonies were held.

Critical need for engineers will be dramatized on a special program to be featured on "Adventures in Research," Westinghouse Electric Corp's radio science show. The program entitled "Supermen Wanted" will be broadcast



THE FIRE WATCH THAT NEVER SLEEPS

ARE you ready for fire *when* it strikes? Week ends? Nights? During shut downs? Put a Kidde Automatic Fire Extinguisher System on the job—it's *always* on the alert against fire.

The heat from a fire hits the Kidde detector . . . sends a signal that releases flame-smothering carbon dioxide automatically. Such a system can protect a single space . . . or many spaces throughout the plant.

Wherever a hazard exists—in engine rooms, fuel storage rooms, document vaults, electrical equipment—you can depend on fire-sensitive, fast-acting Kidde automatic or manual systems to protect your property. Call on us for full information.

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Walter Kidde & Company, Inc., 1031 Main Street, Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

Catalog Bulletins on Sherman Soldering Lugs available upon request.

We put a lot of careful workmanship into the production of all Sherman Soldering Lugs. Dimensions are held to consistent accuracy. Lugs are kept free from burrs, corrosion, etc., and special attention is devoted to maintaining FLAT contact surfaces. All lugs individually inspected before shipment.

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Battle Creek, Mich.

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SOLDERING LUGS

AVOID NIGHT ACCIDENTS . . .

TWIN LENZ
The Double Safety Light for Maintenance Equipment

A double tail light—one stationary and one that extends on 35-ft. electric cable from spring tension pulley drum.

Avoid night accidents and expensive law suits.

Mounts on rear of truck with extension sealed beam red light for coupled equipment . . . makes night flood light when extended on truck booms with red lens raised on simple bracket . . . utility extension light for breakdowns . . . extension red light for road warning.

SAE approved. Recommended by National Safety Council. Write for full particulars. Immediate Delivery.

Interested Distributors and Dealers write for complete information.

HARLAN MFG. CO., INC., Harlan, Iowa

during the week beginning Sunday, Nov. 25. It is designed to aid in the educational campaign now being undertaken by the Engineering Manpower Commission of the Engineers' Joint Council to bring the manpower shortage to the attention of the nation.

Square D Co, Detroit, plans to build an addition to its Milwaukee plant office building. The addition would add 19,200 sq ft of floor space and will cost about $600,000. A plant official said the new structure would free manufacturing space now being used for office purposes.

Kenlow Engineering Co, Chicago, Ill., suppliers of components for utility system load dispatching boards, has been reorganized and has changed its name to Power Dispatchers Equipment Co. The company will offer a full line of dispatching and control boards, from frames and panels to plugs and paints. The basic unit of the line is a standard 4x8 ft panel, adaptable to any dispatching board requirement.

SALES ASSIGNMENTS

COMPANY STAFFS

Westinghouse Electric Supply Co has appointed Henry Czech regional manager in charge of six districts covering the greater part of a 15-state area extending from Montana to Indiana and from Oklahoma to Minnesota. B. H. Boatner succeeds Czech as northwestern district manager. In other appointments C. G. Lammers has been named manager of the consumer products division and J. C. Anderson district lamp and lighting sales supervisor of the northwestern district, and C. W. Barrett service manager in the east central district.

General Electric Co has appointed F. Charles Ruling manager of the Atlantic district of its Apparatus Sales Division. He will be responsible for the sales in Virginia, West Virginia, Maryland, and Delaware; most of Pennsylvania; and parts of New Jersey, North Carolina, and Ohio. Ruling will make his headquarters in Philadelphia. James J. Fitzgibbon has succeeded Ruling as manager of the apparatus sales office in Washington, D. C. Earlier the company named Clifford M. Dunn manager of the Michigan apparatus district. Dunn makes his headquarters in Detroit.

Metal Prices
Oct. 15, 1951

COPPER, Conn., V., lb	$ .24½
LEAD, N. Y., lb	.19
ZINC, prime Western, E. St. Louis, lb	.19½
TIN, Straits, qual. N. Y., lb	1.03
ALUMINUM, ingot, base price	.19
NICKEL, base price	.56½
STEEL, billets, Pitts., ton	56.00
STEEL, scrap, No. 1 heavy, Pitts., ton	45.00

THE NEW Polyken® INDUSTRIAL TAPES

TAILORED TO YOUR JOB

She Keeps 'em Rolling without stops to unravel loose ends. She's using *Polyken* Tape No. 163.

Square D pulls a switch!

That would hardly be big news up in Milwaukee, where Square D makes switches as well as about everything else electrical.

But this switch they pulled is of a different sort.

In wrapping DC magnetic starter coils, they were using ordinary friction tape. This tape collected dirt, was too thick, and did not have the desired tack and adhesion.

But the main objection to friction tape was the fact that the edges unraveled. This meant complete work stoppage until these ravelings could be removed.

They found that they can run through a whole roll of *Polyken* No. 163 Tape without stopping to unravel the edges. This meant many costly hours saved on the production line.

Actually, *Polyken* No. 163 performed better in all respects. Unlike friction tape, which is tacky on both sides and sticks best to itself, No. 163 is a pressure-sensitive adhesive tape that sticks to any clean, dry surface—and its outer backing, which is free from adhesive material, will not collect dirt or grime.

You are probably using friction tape in your plant or shop. *Polyken* No. 163 is suggested for practically every application where friction tape is used. Underwriters' Laboratories will approve the tape on any electric device or apparatus in place of ordinary friction tape.

Polyken, Dept. EWK-2, 222 West Adams St., Chicago 6, Ill.

For specifications, samples, and further information on this and other Polyken tapes, please send me your *FREE BOOKLET*, "Tape is a Tool."

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***Polyken* Industrial Tape, Department of Bauer & Black, Division of The Kendall Company**

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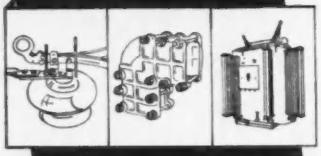
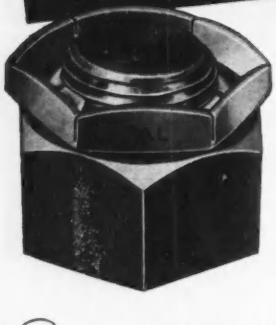


PALNUT
TRADEMARK
LOCK NUTS



Apply a PALNUT Lock Nut on top of each ordinary nut you install and forget about loose bolts, assemblies and connections. Cost is negligible—application takes but seconds—protects for the life of installation. No further checking or re-tightening are needed. Perfect conductivity is assured.

PALNUT double-locking spring action prevents nut from loosening and bolt from backing out. May be removed and re-used. Full range of sizes, in plain, Parkerized and Hot Dip Galvanized steel; also silicon bronze.

Samples and literature on request

The PALNUT Co.
51 CORDIER ST. IRVINGTON 11, N. J.

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

California—Bureau Reclamation, Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., furnishing del. f.o.b. cars shipping point on Roseville, governors with pumping equipment turbines, for Folsom Power Plant, Central Valley Proj. Spec. DS-3568. L. F. McClellan, ch. engr.

Calif., Burbank—Dpt. Commerce, Civil Aeronautics Admin., 5651 W. Manchester Ave., Los Angeles, airport surveillance radar bldg. at Lockheed Air Terminal, Inv. 6-52-115.

Calif., Santa Rosa—State Div. Architecture, P. Wks. Bldg., Sacramento, electrical distr. system permanent facilities at Los Guilucos School for Girls.

Calif., Ukiah—Dpt. Commerce, Civil Aeronautics Admin., 5651 W. Manchester Ave., Los Angeles, remote VHF receiver transmitter station, near here, Inv. 6-52-117.

Ill., Maunee—Association of Illinois Electric Co-operatives, 524 E. Capitol St., Springfield, electric generating plant on Wabash River. $5,000,000. Laramore & Douglas, 79 E. Adams St., Chicago, Zone 3, consult. engrs.

Ill., Skokie—Offner Electronics Co., 5320 N. Kedzie St., Chicago, Zone 25, 1 story, 24,000 sq. ft. laboratory and office, near Oakton St. and St. Louis Ave., $250,000. Friedman, Alschuler & Sincere, 223 Jackson St., Chicago, Zone 6, archts.

Mich., Owosso—Universal Electric Co., George Hoddy, pres., Owosso, 1 story, 60,000 sq. ft. factory. $500,000.

Missouri—Se-Ma-No Electric Co-operative, Mansfield, 69 mi. rural distr. lines, sys. imprvs., Wright Co. $530,000.

Nebraska—Bureau Reclamation, Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars, Gering, grounded-neutral circuit; undergrounded neutral circuit; tank-mounted neutral current transformer for Gering Sub-station, Transmision Div., Missouri River Basin Proj., Inv. No. DS-3567.

Ohio—Morrow Rural Electrical Co-operative, Mt. Gilead, 6 mi. rural distr. lines and sys. imprvs., Morrow Co. $200,000.

Oregon—U. S. Eng., Bldg. 602—City-County Airport, Walla Walla, Wash., project sub-station, McNary Dam, CIVING 45-164-52-31.

Texas and Louisiana—Mississippi River Fuel Corp., 407 S. St., St. Louis, Mo., base radio stations, Woodlawn, Tex. $90,000; one each at Minden and Perryville, La., $115,000 complete; Athens, La., $90,000.

Tex., Calallen—Central Power & Light Co., 120 N. Chaparral St., Corpus Christi, electric power plant. $20,000,000.

Tex., Dallas—Dallas Power & Light Co., Dallas Power & Light Bldg., addnl. construction of transformers at Cedar Crest and Haskell Stations. $161,380.

Tex., Ellington Field Air Force Base—U. S. Eng., 606 Santa Fe Bldg., Galveston, overhead power lines, Inv. No. ENG 41-243-52-30.

Va., Norfolk—Pub. Wks. Office, Headquarters, Fifth Naval Dist., U. S. Naval Base, Norfolk, Zone 11, radio receiving facilities, northwest Virginia at U. S. Naval Communications Station, NOY 28472, Spec. No. 30111. Plans deposit $150.

Wash., Richland—General Electric Co., Richland, prime contractor to Atomic Energy Comm., for operations of Hanford Works, telephone exchange bldg. addn. and laundry bldg., inside restricted Hanford Works reservation.

Wyoming—Bureau Reclamation, Dpt. Interior, Casper, construction of Alcova Power Plant and appurtenant works, Kendrick Proj., downstream from Alcova Dam, approx. 30 mi. southwest of Casper, Spec. DC-3564.

Wyoming—Bureau Reclamation, Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Casper,

CONSULTING ENGINEERS

Must have seven years of industrial plant experience in design, operation or maintenance of electrical equipment involving application of equipment to Power Generation, Distribution, Control, Motor Uses and Lighting.

Will provide Consulting Service to Company Plant and various divisions of our Engineering Department.

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MORE IRON AND STEEL SCRAP . . . OF ALL KINDS!

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What to look for . . .

obsolete machines, tools and equipment, no-longer-used jigs and fixtures, worn-out or broken chains, wheels, pulleys, gears, pipe, tanks, drums and abandoned metal structures. Non-ferrous is needed, too!

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PUBLISHING COMPANY, INC.
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switches, for Alcova Power Plant Switchyard, Kendrick Proj., Spec. CS-3570. L. N. McClellan, ch. engr.

Alaska—Bureau Reclamation, Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., generators for Eklutna Power Plant, Eklutna Proj. Spec. No. DC 3536. Extended date.

Ont., Toronto—Canadian General Electric Co. Ltd., 212 King St. W., plans by Sproatt & Rolph, 83 Cumberland St., transformer factory to be built on 140 acre site in Etobicoke industrial area also 200 houses for staff, $12,000,000. Proctor, Redfern & Laughlin, 11 Jordan St., consult. engrs.

Low Bidders & Contracts Awarded

Arkansas-Missouri — Southern Line Constr. Co., Falls Bldg., Memphis, Tenn., LB, $292,411, constr. 288.8 mi. new rural distr. lines in Barry and Stone Counties in Mo and Boone, Carroll, Madison, Newton and Searcy Counties, Ark. Carroll Electric Co-operative, Afton Wheeler, pres., Berryville, Ark. Bids Sept. 19.

Calif., Moffett Field—Carl N. Swenson Co., Inc., 1095 Stockton Ave., San Jose, Calif., LH, $1,033,781, foundations for 8 ft. supersonic wind tunnel Spec. A-6750. National Advisory Comm. for Aeronautics Ames Laboratory, Moffett Field, Calif. Bids Sept. 25.

Fla., Miami—Whitmore Elec. Co., Langford Bldg., Miami, Fla., CA $146,897, underground electric distr. sys. at Jackson Memorial Hospital, Dade Co. Court House, Miami, Fla. Bids Oct. 2.

Mich., Erie—Service Products, Inc., N. Westwood Ave., Toledo, O. CA $450,000. install heat insulation for all piping equip. and 2 Babcock boilers at Whiting Electric Generating plant. Consumers Power Co., Jackson, Mich.

Miss., Cleveland—Mississippi Power & Light Co., Lampton Bldg., Jackson, Miss., Owner Builds. $20,000,000. Delta Steam Electric Generating plant.

Nebr., Holdrege—R. W. Hughes & Co., Sunderland Bldg., Omaha, Neb., CA. $229,426, municipal electrical sys. extens. City, Holdrege, Neb.

Nebr., Omaha—Omaha Public Power Dist., 17 and Harney Sts., Omaha, Neb. Owner Builds. $675,000. Shop and service Bldg. addn., 43 and Leavenworth Sts.

South Dakota—Douglas Contractors, Keeline Bldg., Omaha, Neb., CA. $715,402. 710 mi. rural distr. lines, Haakon, Jackson, Jones and Stanley Counties. West Central Electric Co-operative, Murdo, S. D. Bids Sept. 18.

Wis., Milwaukee—F. Kutschenreuter, 613 N. 119 St., Milwaukee 13, Wis., CA, $300,000,power house addn. American Hair & Felt Co., 944 N. 46 St., Milwaukee 13, Wis. Gates, Moe, Weiss & Papenthein, 611 N. Broadway, Milwaukee 2, Wis., engrs. and archts.

Wis., Milwaukee—Hunzinger Constr. Co., 4577 N. 124 St., Milwaukee 13, Wis., CA, $312,000, 1017 ft. high, steel television tower, concrete fdn., WTMJ-TV, 720 E. Capitol Dr., Milwaukee 12, Wis. Chas. S. Whitney, 720 E. Mason St., Milwaukee, Wis., engr.

Que., Montreal—J. P. Cartier Ltd., 429 W. Jean Talon St., Montreal, Que., CA $189,897 cold storage chambers addns., imprv. electrical and heating systems. Municipality, Montreal, Que. D. Beaupre, 811 Berol St., Montreal, Que., archt.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ill., Chester—Colchem Corporation, c/o Ferdinand Eberstadt & Co., Wall St., New York, N. Y., constr. coal hydrogeneration plant on 38,000 acre tract along Mississippi River adjacent to here. $100,000,000-$400,000,000.

La., Baton Rouge—Esso Standard Oil Co., North Baton Rouge, refinery expansion, $35,000,000; chemical plant expansion, $10,000,000.

Low Bidders & Contracts Awarded

Ga., Rome—Maxon Contr. Co., Inc., 1733 Chapel St., Dayton, O., CA, $25,000,000, Container Board, mill. Rome Kraft Co. (Mead Corp., 118 W. 1 St., Dayton, O. and Inland Container Corp., 700 W. Morris St., Indianapolis 6, Ind.), Rome, Ga.

Has What It Takes

For Guys, Messenger and Overhead Ground Wire

EXPERT linemen know, when they use *Crapo* Galvanized Steel Strand, that it will meet every requirement the job demands. For *Crapo* Galvanized Strand "has what it takes" — *strength, ruggedness, workability, long-life.*

These essential characteristics, combined with ever important ECONOMY, make *Crapo* Galvanized Strand first choice for guys, messenger and overhead ground wire. The superior tensile strength of the steel is utilized to fullest advantage in each size and grade. The heavy, ductile, tightly-adherent galvanized coating — applied by the famous *Crapo* Process — provides dependable protection for the steel, prolongs the expectant life of the strand.

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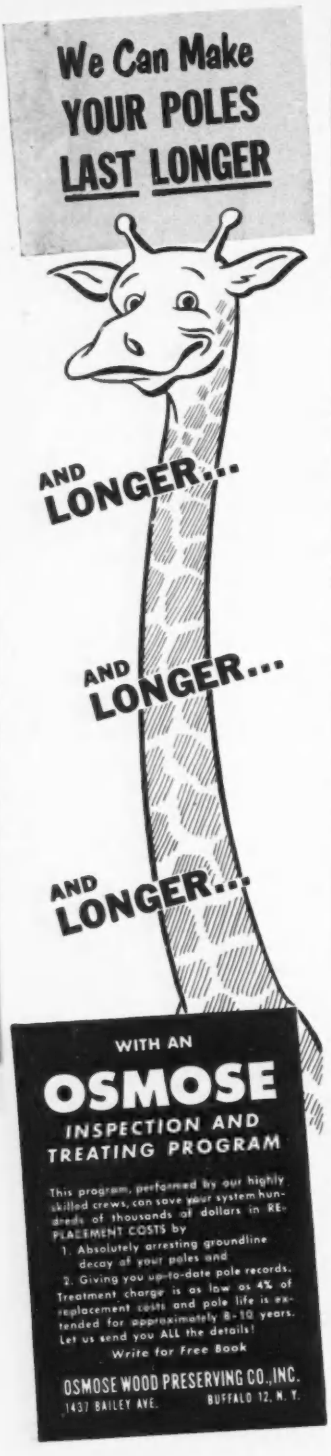
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LAST LONGER
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INSPECTION AND
TREATING PROGRAM
This program, performed by our highly skilled crews, can save your system hundreds of thousands of dollars in REPLACEMENT COSTS by
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CATALOGS • BULLETINS

● EQUIPMENT TERMINATORS: Of interest to designers and engineers is an 8-page publication 5010 describing Delta-Star equipment terminators. Terminators come in single conductor and three conductor types, and are used in connecting insulated cables to transformers, switchgear, and similar apparatus. Complete catalog data for diverging bushing types and parallel bushing types, both air immersed or oil immersed is included. Catalogs available from Delta-Star Electric Co, 2400 Block, Fulton St, Chicago 12, Ill.

● SPEED REDUCERS: A 6-page handy reference book illustrates and describes the application of Falk speed reducers, couplings, gears, and motoreducers in various industries. Line drawings and photographs depict all possible geared power transmission applications. Tables are included with dimensions and other data on most sizes of couplings. Bulletin 4115 available from Falk Advertising Department, The Falk Corp, Milwaukee 8, Wisconsin.

● TRANSFORMERS: "Transformer Banking Connections," bulletin 9-50, prepared by the Rural Transformer & Equipment Co presents data on various transformer conections. Covered in the bulletin are banking of single phase double bushing transformers for wye-delta 3-phase loads, open wye-delta 3-phase loads, and combination single phase lighting loads and 3-phase power loads. Also included are methods for banking single phase single bushing transformers for various combination power and lighting loads. In addition, tables of allowable current capacities of wires, motor full load currents, transformer full load currents, and recommended series links for transformer protection are included. Prepared by Rural Transformer & Equipment Co, Milwaukee, Wisconsin.

● PENTA-CHLOROPHENOL: A "fact guide" for users of Penta-pressure-treated lumber has been prepared by the Dow Chemical Company. This booklet describes the advantages of Penta in treating wood for varied applications the wood may be used for. Test plot records for treated wood are presented, as are the various methods of wood treating of different types of wood. Copies available from Dow Chemical Company, Midland, Michigan.

Transformer Loading

(*Continued from page 109*)

typical load curve and a daily average ambient of 10 C. We have prepared simplified methods of calculating secondary voltage drop, based on customer spans which cause a 3-v drop in 120 v. These calculations often help determine whether to replace an overloaded transformer or to split the secondary and hang a new one. About 80% of all our transformers are replaced on the basis of load calculations in the office.

Voltage Regulation . . . At higher loads voltage regulation is a problem for consideration. The Connecticut commission specifies limits of plus 5% and minus 3%. Voltage drop in an average transformer is shown in Fig 7. At 90% power factor this is

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1. Gives a practical knowledge of atomic and nuclear fundamentals, in terms as simple as possible. Includes a thorough treatment of the kinetic theory of gases, the charge and mass of electron, electronics, photoelectric effects, X-rays, the Rohr theory of the origin of spectral lines, and electron configuration in atoms. Presents the most recent advances in investigating nuclear phenomena, the development of atomic energy, etc. **By Saul Dushman, Research Consultant, Gen. Elec. Co., Schenectady. 294 pages, illus., $5.50**

ELECTRICAL APPLIANCE SERVICING

2. How to test, repair, and service all home electrical appliances. Gives theory, construction and trouble-shooting remedies on everything from toasters to refrigerators—from home wiring systems to resistance-heating appliances, motor-driven appliances and refrigeration and air-conditioning appliances. Includes suggestions on how to set up and operate a servicing business of your own. **By William H. Crouse, Formerly Director of Field Education, Delco-Remy Division, General Motors Corp. 534 pages, 727 illus., $7.50**

RURAL ELECTRIFICATION ENGINEERING

3. This book covers the fundamental design features of rural distribution lines: the basic factors underlying the application of electricity to heat, light, and power; and the administrative problems involved in a sound, progressive rural electrification program. **By U. F. Earp, Assoc. Agr. Engineer, Va. Agr. Experiment Station. 313 pages, 278 illus., $4.00**

ELECTRIC DISTRIBUTION FUNDAMENTALS

4. Provides sound solutions to problems of electric distribution, essential data on design and construction, operation, and service, methods and equipment, and mechanics and materials. Discusses how the distribution system works—how it is planned, designed and constructed—how service and operating routine is handled. Covers voltage, drop, wire size calculations, etc., etc. **By F. Sanford, Copper Wire Eng'r. Assoc. Second Edition. 252 pages, 163 illus., $4.00**

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about 2.1% for 100% load and 3.5% at 167% load. Loads at the 167% of this level occur perhaps but part of an hour for a few days in the annual peak month in many cases. Again, only transformers beyond the load center are likely to have low primary voltage. If we assume reasonable upper limits for loading, keep secondaries from getting too long, and maintain good primary voltage levels with some compensation for transformer voltage drop, we should have no trouble.

Ratio of copper losses to watts delivered in a representative transformer is shown in Fig 8. These values range from infinity at zero load to a minimum at about 75% rating and rise again as load increases. This loss curve has been applied to a typical transformer load cycle in Fig 9. Two transformers were assumed, one with a peak load of 90% and one with 180%. Percent losses were plotted by the hour. Average percent loss is lower for the transformer loaded to the higher level. This indicates that losses are less serious than one might think, although losses on the peak hour need consideration.

Heavier Loads . . . Loss of transformer life should not cause concern where burnout rate stays within reason. Most transformers are applied to a growing system and if final load limit is known approximately, initial sizes can be chosen to allow for a reasonable life. In Fig 10 is shown the effect of various replacement spans on transformer investment. Four life spans were assumed: 10, 13, 16, and 20 years. In each case initial load was 15 kva, growth rate 5%, and final load 167% of capacity originally chosen to serve 15 kva. In this case a slight reduction in cost is indicated for a longer life span. With the 20-yr span average load on the transformer was 22.5 kva on 18 kva of transformer capacity, or 125%. The last year of the unit's life in this location is the only one which approaches overload. If conditions are unfavorable, ie, high ambient or long load cycle, a few percent of life might be sacrificed. However, the unit will last only about two such load cycles before it is likely to be retired for other reasons. Permissible loading is not the whole criterion. A proper balance should be sought between regulation, voltage levels, secondary lengths, and supply costs.

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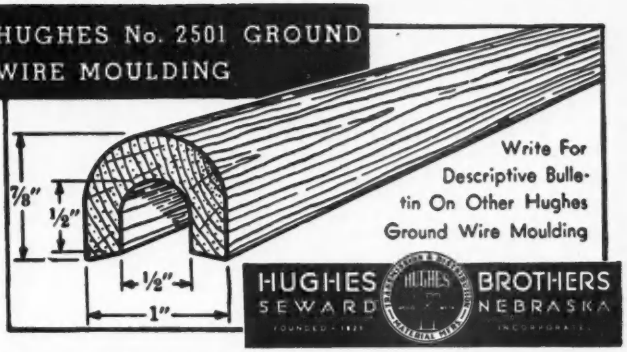

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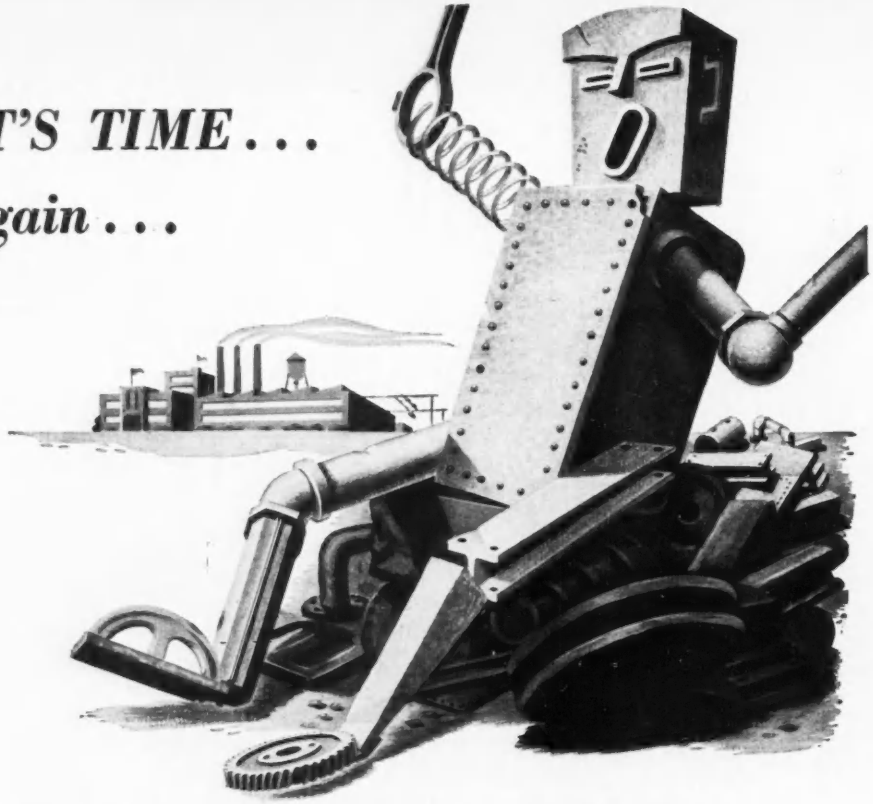

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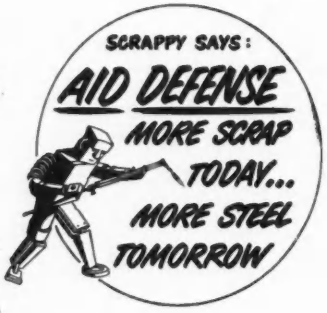

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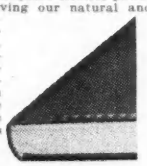

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U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-3562) will be received by the Bureau of Reclamation, Denver, Colorado, until November 13, 1951, and then publicly opened for furnishing one 1,700-ampere bus structure and one generator-voltage switchgear assembly for Pole Hill Power Plant; and one generator- and motor-voltage switchgear assembly for Flatiron Power and Pumping Plant, Colorado-Big Thompson Project, Colorado. Delivery is desired within 420 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-3565) will be received by the Bureau of Reclamation, Denver, Colorado, until November 15, 1951, and then publicly opened for furnishing three 60,000-kva, 13,200-delta to 230,000 wye-volt, 3-phase, 60-cycle, oil-immersed, forced-oil-cooled, outdoor-type transformers with water-cooled, external heat exchangers for the Folsom Power Plant, Central Valley Project, California. Delivery is desired within 700 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-3567) will be received by the Bureau of Reclamation, Denver, Colorado, until November 15, 1951, and then publicly opened for furnishing one 27,000/36,000-kva, 115,000/66,400- to 13,200-volt, 3-phase, 60-cycle, oil-immersed self-cooled/forced-air-cooled, outdoor power transformer, with lightning arresters and a neutral current transformer for Gering Substation, Nebraska, Missouri River Basin Project. Delivery is desired within 720 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

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The key mechanism of ex Government device for seeing in the dark. Bargain $3 each to clear.
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DIESELS—FOR SALE
2—1250 HP, 4 cycle, 164 RPM Macintosh-Seymour diesel engines driving 850 KW, 2 phase, 2300 volt, 60 cycle generators (can be rewound 3 phase). Units now in Central Station operation, probably available May 1952. Contact Commissioner of Public Utilities, Rockville Centre, N. Y.

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WIRE — CABLE — WIRING MATERIALS
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SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
1	7500	G. E.	1φ8000—41000, 3 ph.
3	3333	West.	132000—7620/13200 Y
3	1000	West.	66000—7200
3	500	G. E.	66000—2400
4	2500	West.	44000—11000
3	1500	Wag.	44000—6900 NEW
3	200	Mol.	44000/22000—440/220
3	8333	West.	43800—13900
1	18750	A.B.B.	34840—11000, 3 ph.
6	1500	Pitts.	33000—2400
3	200	West.	33000—7200/12470 Y
4	150	G. E.	33000—7200/12470
6	150	G. E.	34500—4600/2300
3	100	A. C.	33000—7200$12450 Y
3	75	Mol.	3300—2300
3	75	Wag.	33000—7200/12470 Y
4	450	A. C.	25410/44000—13250/23000
3	200	G. E.	23000—7200
3	333	G. E.	138000$6900—2300
2	667	Pitts.	13200—2200
3	200	Mol.	11000—2300
3	150	Mol.	7620/13200 Y—120/240
3	667	Kuhl.	7200/12470 Y—2400
3	100	West.	7200/12470 Y—2300
3	37½	Pitts.	6900—230/460
3	75	West.	6600—460/230
1	100	G. E.	2300—575, 3 ph.

INDUCTION REGULATORS

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
2—120 KVA G. E. 500/1000 A. 2400 V. O/D
2— 46 KVA West. 200/400 A. 2300 V.
6— 36 KVA G. E. 150 A. 2400 V.
2— 36 KVA G. E. 75/150 A. 4800 V.

CIRCUIT BREAKERS

4—600 A. 154 KV G. E. FHKO— 39-2500 MVA
1—600 A. 73 KV G. E. FHKO—139-1000 MVA
1—400 A. 37 KV West. 0—221—500 MVA
1—400 A. 15 KV G. E. FKO—37—40
1—400 A. 37 KV G. E. FHKO—136— 350 MVA
4—600 A. 15 KV G. E. FHKO—139— 750 MVA

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1 Phase, 60 Cycle

3 — 500 KVA G-E 66000 — 2300
2 — 500 KVA W-H 13200 — 240/480
3 — 400 KVA W-H 13200 — 600/575/550
3 — 333 KVA G-E 44000/33000 — 2400/500
3 — 250 KVA W-H 13800 — 2300
3 — 200 KVA G-E 13200 — 120/240
3 — 150 KVA G-E 44000 — 6600
3 — 100 KVA G-E 33000 — 6900/11950Y
3 — 50 KVA A-Ch 33000 — 2400/4160Y

3-Phase, 60 Cycle

2 — 750 KVA W-H 13800 — 480 DRY
1 — 4000 KVA W-H 15000/12750 Auto

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A.C.—50 AND 60 CYCLES

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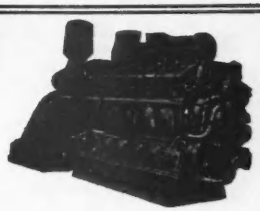

A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	33F16	2000	300	375	Enterprise	DSG-6	450	450
1420	Fairbanks Morse	38D8⅛	1600	720	330	Superior	KNA	396	514
1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
937.5	General Motors	12-567	1080	720	312	Clark	MD-4	375	327
625	Alco	6-12½x13T	750	600	125	Ingersoll Rand	S	225	514
425	Baldwin	VO-6	510	450	187	General Motors	6-268A	150	1200
400	Buckeye	80	480	600	75	General Motors	6043C	90	1200

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ENGINE DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

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TURBO GENERATORS

Qu.	KW	Make	Desc.
1	4000	Al. Ch.	Condensing 200/250 I.S.P. 2300 v. 2/60 Exc. & Surface Cond.
2	750	G.E.	Condensing — 425 lbs. 750 T.T. I.S.P. 440v. 3 ph. 60 cy.— Built 1944
1	400	Westg.	Non-condensing — 12½/150 lbs. I.S.P. 5/10 lbs. B.P.— 240/480 v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.— 480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

	KVA	Make	Type	Volts	Speed
1	5000	Whse.		2400/4150	600

MOTOR GENERATOR SETS
3 ph. 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
2	2000	G.E.	600	600 25 cy.	11000
1	1500	G.E.	720	600	13200
1	1500	G.E.	360	275	2200/4400
1	1000	Whse.	900	600	4150
1	1000	G.E.	900	260	4100/6900
1	750	Whse.	900	275	2300/4150
2	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G.E.	900	600	2300/4000
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300
1	400	G.E.	720	250	440/2300
1	250	G.E.	900	125	4150
1	240	G.E.	1200	250	2300

TRANSFORMERS—60 Cycle

	KVA	Make	Type	Ph	Voltages
2	4000	G.E.	HT	3	22000x2300
3	2250	G.E.	HVDDJ	1	6600x440
4	333	G.E.	HKDD	1	13800/6900x230/460
6	300	G.E.	HT	3	2400x240/480

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3—1500 KVA Pittsburgh, 1 Ph., 22,000-2200Y
1—1500 KVA G.E., 3 Ph., 4150V, 2300V Pyranol
2—400 KVA Pittsburgh, 1 Ph., 2400/4800-240/480 Scott-Taps
3—400 KVA G.E., 1 Ph., 4800V 2300V Sec.
1—200 KVA G.E., 3 Ph., 2400V 220 Sec.
3—200 KVA Whse., 1 Ph., 2400-480V
6—50 KVA G.E., 1 Ph., 13,450V, 120/240 Sec.

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1—300 H.P. Elec. Mach. 720 RPM, 3 Phase 60 cy., 2200V. Totally Enclosed Fan Cooled Outdoor service.

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1—200 KW Whse., 275V, 900 R.P.M., 220 V. Syn.
1—175 KVA West., 1 Ph. 220V, Motor 3 Ph. 440V.
1—150 KW G.E., 125/250V, 1200 RPM, 2300 Syn.
1—100 KW, Allis-Chalmers, 125/250V, 900 R.P.M. 480V Sc.

SLIP RING MOTORS

1—2500 HP G.E., MT, 257 RPM, 6600V.
1—250 HP West., CW, 600 RPM, 440V.

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LETTERS TO THE EDITOR

Electric Rate Increases

To the Editor:

Your article "Numerous Electric Rate Increases" with accompanying illustrations in the September 10th issue of Electrical World illustrates a point which has bothered the writer for some time. In none of the publicity which I have seen on rate increases has there been any recognition of the technological advances which have permitted "holding the line" on cost of electricity in spite of rising costs on everything else.

In the minds of many of the public there appears to be a growing opinion that in the past they have really been badly overcharged for their electricity, since its cost obviously hasn't followed the general price trend. Now the opinion seems to be that the profit margin has been brought down to normal, so rate increases are being requested.

It would seem that any publicity on the subject should recognize this condition and tell the whole story, if only as preparation for the inevitable day when the trend reverses and prices decline. At that time electric rates should also decline, but not in the proportion now in the minds of the public, if reasonable rates of return are to be realized.

T. C. Hoyt

Armonk Village
New York

The Curve Is Familiar

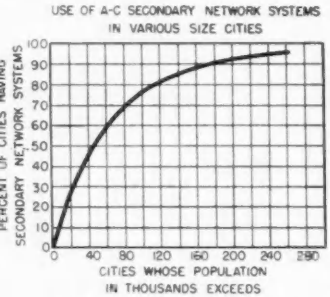
To the Editor:

Relation between percentage of cities having secondary network systems and population of these cities is illustrated in a graph on page 8 of Electrical World, August 6, 1951. This curve is remarkable because it exactly represents Helmholtz's equation, usually known in the form $i = I\ (1 - E^{-\frac{t}{T}})$. This equation applies to the closing of a dc circuit containing reactance and resistance and describes the relation between increasing current i and time t. I is the ultimate current, and $T = L/R$ is called the time constant. E is the base of the natural system of logarithms.

In our case the equation may be written $n = 100\ (1 - E^{-\frac{p}{P}})$, n being the percentage of cities having secondary network systems, p the population figures of the cities, and P a constant which might be called progress retarding constant. In this instance $P = 80{,}000$ population. It seems that this law of impeded growth may be applicable in other cases where technological or sociological matters and size of population are involved.

Albert M. Schlick
Professional Engineer

23 Stone Street
Bloomfield, N. J.



RELATION between cities having secondary networks and their population is familiar Helmholtz equation

Article Was A Service

To the Editor:

It seems to me that you are doing a real service to the utility industry in publishing R. G. Kloeffler's article, "Don't Utilities Really Want Electrical Engineers," Electrical World, July 30. From my experience, it appears that his basic story represents quite generally the situation in the whole country. Similar warnings have been given by others and I would like to refer to the warning to the utility industry by Dr. Terman of Stanford during the Eta Kappa Nu banquet last January at the AIEE Meeting in New York City.

I am, however, in disagreement with your artist who makes the leader of your group of graduate engineers carry a T-square. A period in the drafting room should be part of the training of an entering engineer, but this period should be short. The graduate engineer has not prepared himself to be a draftsman, and though some jobs in the "design field" are best done by graduate engineers, the T-square is not the tool which should symbolize the graduate engineer.

Eric T. B. Gross
Dept of Electrical Engineering
Illinois Institute of Technology
Chicago, Illinois

In the next issue

Trade Marks and Trade Names for Power Cables and Insulation . . .

Used by more than 60 wire and cable manufacturers in this country

Raise Engineers' Pay

To the Editor:

The need to interest young men in a career in engineering has recently been the subject of a number of articles by well known engineers and letters to the editor of Electrical World. It is my belief that the most effective approach to this problem would be to raise the salary level of engineers by 100%.

As things now stand I would discourage a young high school graduate by merely telling him the economic facts of remuneration in the engineering profession. As an example, I would tell him that a young doctor friend of mine took his first job in a clinic as an eye specialist at a starting salary of $10,000 per year, and that few engineers are paid that much at the peak of their careers.

Until the basic reason for the shortage of engineers is recognized and corrected, the shortage is going to continue to grow.

B. H. Sexaner
Electric Engineer
Coast Counties Gas & Electric Co.
Santa Cruz, Calif.

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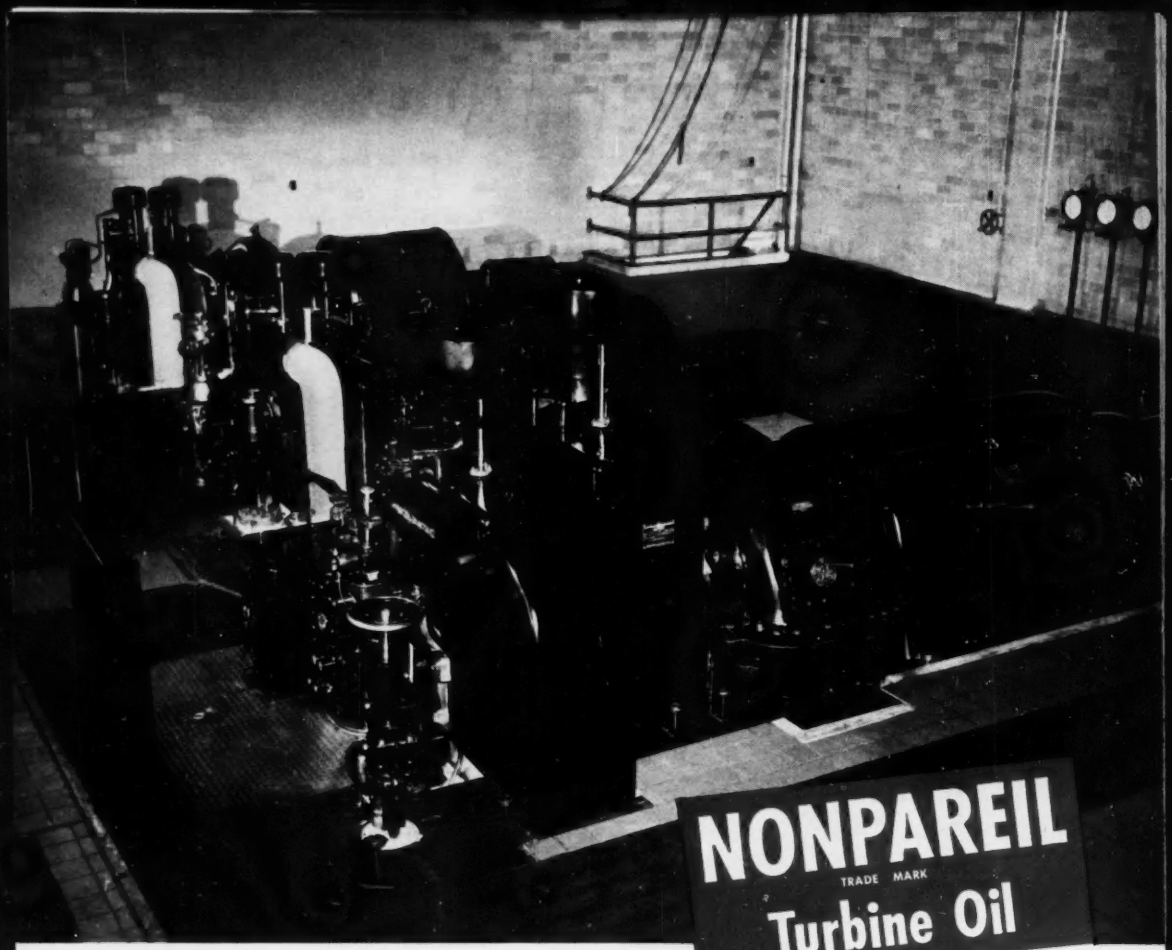

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Installed in the two 1250-KW generators in the background in June 1934, and in the 2500-KW unit (foreground) in 1947, NONPAREIL has never required removal for treating or for cleaning of the common lubricating system. The result: real operating economy and trouble-free lubrication for Theo. Hamm Brewing Company, St. Paul, where these turbines are in service.

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